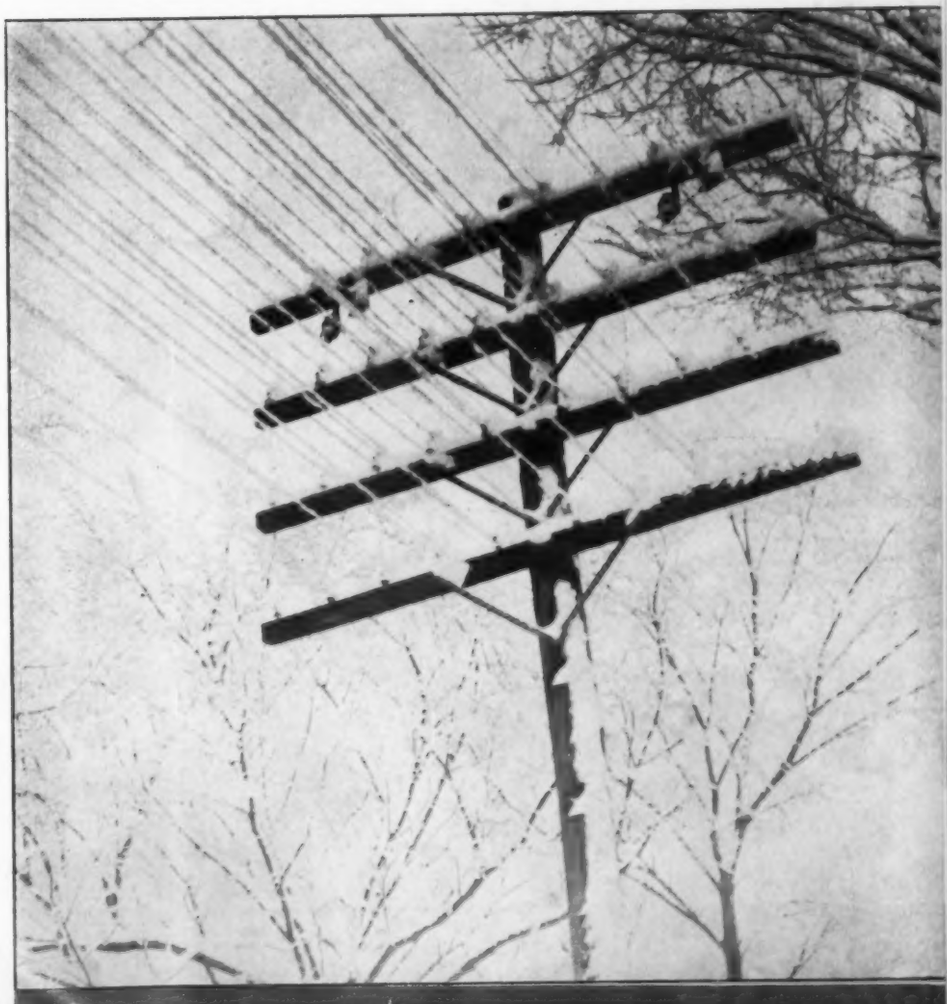
TELEPHONE ENGINEER

MANAGEMENT • ENGINEERING • MAINTENANCE

DECEMBER
1937



Merry Christmas - 1937

GENERAL

Where", writes a subscriber from far off Australia, "does this chap Zenn Kaufman get all of his ideas on Showmanship as described in his series in TELEPHONE ENGINEER?" He further states that he tried one of them and much to his surprise and enlightenment it proved an immediate success. Querying Zenn in regard to the question and coyly asking if they come from Santa's bag our facetious remark was returned by the ever-sales-conscious author who informs us that reading a copy of his book, Showmanship in Business, would answer that question and many more.

▼

While on the subject of Santa's bag, the Christmas of 1937 might be long remembered by the independent industry. Reserving our right of belief in Santas actual existence we believe that officers and directors of the United States Independent Telephone Association could well qualify for the role this Xmas. Announcement of a new schedule of compensation on Special Bell Services plus the rumor that REA might reverse their stand on inductive interference adjustment to telephone companies are two gifts the Independents have nestling in their stockings already.

▼

Not to be outdone in Christmas announcements we are working on a gift stocking for advertisers who make our January Annual Buyers Guide the success it is. This gift is in the shape of a 50% BONUS circulation for that issue so ALL telephone companies can have this handy, complete and simplified Buyers Guide at their elbow during January, for all-year service.

TELEPHONE ENGINEER

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RELAY

KELLOGG SWITCHBOARD AND

TELEPHONE ENGINEER
MANAGEMENT · ENGINEERING · MAINTENANCE

DECEMBER, 1937

"Tapping In" On Washington

By ROLAND C. DAVIES
Editor
Telecommunications Reports

● With the reorganization and rearrangement of its functioning through the elimination of the divisional setup now rather fully formulated, the FCC is slated during the next few months to be delving into important problems and questions which may bring forth some significant policies in regard to the communications industry.

Two major problems are before the Commission—the final drafting of the Telephone Investigation report for transmission to Congress and the analysis of the effect of the business recession upon the communications industry particularly the wire telegraph services. One of these problems, the Investigation report, will demand immediate action during the latter part of December or in early January. Under the direction of Commissioner Paul A. Walker, a corps of Investigation staff workers has been industriously engaged in drafting the proposed report for submission to the entire Commission. The seven members of the FCC then are slated to spend the latter part of December in an intensified final review and formulation of the report so it can be transmitted to Congress. The report, when it is sent to Congress, will be referred to the Senate and House Interstate Commerce Committees, which originally authorized the $1,500,000 inquiry as those two committees will be changed with the consideration of any legislative recommendations for the telephone industry, proposed by the FCC.

● The situation in the telegraph industry has been receiving careful attention by FCC officials, it is known. Of interest to the telephone industry, particularly, will be any moves which the FCC may consider launching in regard to the teletypewriter exchange service. One thought has been the revival of the idea that the commercial development of the teletypewriter exchange service could well be a part of the operations of the established wire telegraph companies as has been proposed when TWX service was inaugurated. The discussion of this situation is still in a nebulous stage and there has been no formal consideration by the FCC of any steps which might be undertaken.

The inactivity of Congress during the special session in the enactment of legislation contains two factors of hopeful promise — first, that Congress has returned to the pre-New Deal methods of actual drafting of its bills and second, that the committees charged with the task of preparing important measures, especially the tax legislation, are proceeding with care and meticulous study of the bills before formulating them into final form. It is felt in many competent circles that the tax revision measure is being drafted with notable care and will result in a law which will afford business a competent yardstick for its future planning.

● On the Congressional front there are practically no measures of specific significance for the telephone industry. The proposed investigation of the FCC has been definitely shelved by its sponsors, Senator Wheeler and White, so as to give Chairman McNinch ample time to revamp any phases at the Commission which need correction. The Federal incorporation licensing bills, sponsored by Senators Borah and O'-Mahoney, which are the first wedge in the anti-trust drive, do not affect the telephone companies because telephone carriers are specifically from its proposed regulartory provisions.

Nation's Telephone Plant In Shape For Any Business Rise

One of the most interesting and significant analyses of the telephone industry by a Federal Goverment agency was the recent report on the construction and maintenance outlook in that field which was prepared by the Federal Reserve Board for the President in connection with his drive to revive pansion of plants by the major "durable expenditures for rehabilitation or exgoods" industries.

● A study of the status of the Bell System was understood to have resulted in the report being transmitted to the White House that the nation's telephone plant and equipment and plant reserves are sufficiently large for efficient operations and to handle any immediate growth of traffic. There was noted an absence of deferred maintenance. Even with a return to

prosperity, the report indicated there was "no squeeze" in sight either in construction or repair work for the telephone industry, which signalizes the reasons why telephone service is maintained at such a high level of efficiency and speed.

If recovery should get under way again and should be followed by a period of prosperity, the survey predicted that an orderly rise from the present level of plant and maintenance expenditures to a prosperity level could be expected. On the basis of present labor and material costs, the survey forecast that the Bell System in the next period of prosperity would expend between 700 and 800 millions of dollars a year as compared with the present 1937 outlay for constructtion and maintenance of $600,000,000.

● The survey did cite that in certain individual instances there were occurring impending shortages of plant but declared these can be readly cared for and forestalled and were being remedied as the needs arose. The shift from manual to dial switching, which made rapid progress during the late twenties and tended to accelerate the retirement of old equipment, was now in a status of diminishing returns or a retarded rate of such conversions. It was pointed out that locations favorable to the dial conversion were growing fewer so there was less opportunity for profitable retirement of manual equipment which was in good condition. Technical improvements, such as the coaxial cable, multichannel carrier transmission, better switching units, improved handsets and buried wire facilities do not bulk large in plant expenditures at the present time in comparison with the plant replacement of the twenties. But it was noted that the future may present an acceleration of the replacements as the aged facilities accumulate in large bulk. Because of the pre-depression construction, it was cited the proportion of antiquated facilities in the Bell System plant is at a low ratio now.

The future growth of the telephone industry was considered to lie in the increasing of the ratio of telephones to the family population, according to the survey. If recovery should again be resumed, it was felt the expansion of a reasonable expectation and, if prosperity should come, it was forecast that telephones in that direction would be there would be a rate of increase of 500,000 telephones a year. The major gain will be in residential telephones, it was predicted, while the proportion of business telephones would not increase in the same ratio. Barring a set-back of serious consequences in business the report to the White House predicted that the outlook of increased stations was very bright.

● The economic report recognized the distinction of the telephone industry from other utilities in that the tendency was the telephone plant and equipment expand more rapidly than its output. The need for interconnecting every subscriber was cited as the reason for the distribution. The report to the President also did not condemn the pre-depression plant construction planning of the Bell System and taught any errors, if they could be considered as such, were fortuitous and sporaido. The attitude in the report was entirely different from that taken in the FCC Investigation which had charged the Bell System with patent ineptitude.

CONVENTION SCHEDULE

Minnesota Telephone Association, Radisson Hotel, Minneapolis, January 25, 26 and 27.

Texas Telephone Association, Adolphus Hotel, Dallas, March 23, 24 and 25.

Oklahoma Telephone Association, Huckins Hotel, Oklahoma City, March 29 and 30.

Missouri Telephone Association, Hotel Muehlebach, Kansas City, April 4 and 5.

Iowa Independent Telephone Association, Fort Des Moines Hotel, Des Moines, April 12, 13 and 14.

Nebraska Telephone Association, Hotel Paxton, Omaha, April 19 and 20.

Kansas Telephone Association, Topeka Hotel, Topeka, April 27 and 28.

Ohio Independent Telephone Association, Deshler-Wallick Hotel, Des Moines, April 12, 13

Indiana Telephone Association, Claypool Hotel, Indianapolis, May 11 and 12.

Pennsylvania State Telephone & Traffic Association, June 2, 3 and 4.

New York State Telephone Association, Seneca Hotel, Rochester, June 7, 8 and 9.

Analysis Of Prudent Investment Impact Upon Telephone Industry

The outcome of the Administration's drive to establish prudent investments as the major medium for the rate base valuation seems to be still far off. But the views of several authoritative governmental sources on the subject, which were secured by *Telephone Engineer*, appear to shed some light on what effect would result from the imposition of the prudent investment principle upon the telephone industry.

● The question mark in the matter is what would be the definition of prudent investment which regulatory bodies would utilize in their evaluation of the telephone companies' rate base. Most of the government authorities seemed to feel that the telephone industry, because it has been under governmental accounting regulation since 1913, and because the vast preponderance of its plant has been constructed by the companies themselves, would fare fairly well in any conversion from the present fair value method, embracing reproduction cost new and original cost.

Book cost, if it is actual, legitimate, original cost, can be regarded as synonymous to original or historical cost upon which prudent investment is predicted. The prudent investment theory is pointed more towards the elimination from plant values of inflated costs and prices brought about in the acquisition of competing or "nuisance" properties and would have a much greater impact upon the power and gas industries than the telephone industry, it is believed.

As an illustration that prudent investment does not work a hardship upon utilities, it is cited by regulatory authorities that the utilities in California weathered the depression better than in most sections. In California historical cost has been the valuation yardstick for approximately a quarter-century. The best exposition of the prudent investment theory is held up by governmental authorities as the view expressed by Justice Brandeis in his dissent in the Southwestern Bell case as follows:

● "The term prudent investment is not used in a critical sense. There should not be excluded from the finding of the base, investments, which under ordinary circumstances would be deemed reasonable. The term is applied for the purpose of excluding what might be found to be dishonest or obviously wasteful or imprudent expenditures. Every investment may be assumed to have been made in the exercise of reasonable judgment, unless the contrary is shown.

Recent Activities at FCC

Because it has been so busily engaged in the rearranging of its "furniture" because of the elimination of the divisions, the FCC has handed down few significant decisions in recent weeks. The fact that the Commission

(Please turn to page 43)

Association Announces New Compensation Schedule With Bell

● Subsequent meeting on December 11th resulted in an agreement on teletypewriter exchange service with the compensation of 6c incoming and 6c outgoing which association officials are now making public.

We are reproducing below the report issued by the United States Independent Telephone Association under date of December 6. It is self explanatory and will be hailed by all Independents throughout the country as one of the outstanding accomplishments by association officers and directors for 1937

Increased Compensation Starts January 1st, 1938.

To all member companies:

The Association is pleased to announce to its members the attached new schedule of compensation agreed upon between representatives of the Long Lines Department of the American Telephone and Telegraph Company and our Committee on Special Bell Services, and approved by our Exeecutive Committee on December 1st.

This schedule meets generally the request of the Association set out in the following five-point program:

(1) In two-way point-to-point service, 05% of the entire revenue shall be considered as originating in each territory.

(2) For short-period and full period talking service, conference, multi-exchange, or other similar special services, the entire revenue for the service shall be divided equally among the exchanes in volved and be considered originating business.

(3) By the term "entire revenue", as used in (1) and (2), is meant all charges for the service, excluding local loop rental and non-recurring items such as installation and move charges.

(4) In teletypewriter exchange service, the definition of "originating business" shall be the same as in the toll agreements in effect between the Independent company involved and the Bell company.

(5) With "originating business" as defined in (1), (2) and (4) as the basis, the rate of commission paid Independent companies in connection with these special services shall be not less than the rate of commission now received by those Independent companies in connection with toll business, and to that commission there shall be added a suitable allowance* for equipment furnished by the Independent company; provided that in those cases where the commission on tolls is based on separate percentages of uotgoing and incoming tolls the percentage to determine th: commission on th: special services shall be the percent the total commission received on such toll contracts is of th: total originating tolls.

Number 4 — teletypewriter exchange service is not covered in the attached schedule. This particular class of service is still under discussion. A favorable decision in this item is anticipated at an early date, (See first paragraph this article.)

Conference toll service mentioned in Item 2 remains as a toll service not included.

Consideration was given to the matter of loop charges which the Independent companies will receive in addition to the compensation above-mentioned, and the Association recommends to its member companies and in no case should these loop charges exceed the regular rate for individual business line service. In many cases, the Independ-

(Please turn to page 28)

Monthly Commission Schedule — Connecting Companies Private Line No.

Where the toll rate air-line distance from the Connecting Company point to the most distant point on the private line is

Over	But Not Over	The monthly commission per Connecting Company two-way* station will be the percentage shown below applied to the average Interchange Channel and Drop Service Revenue per station for all stations (one way and two-way) on the service
0 miles	50 miles	25%
50	65	23
65	80	21
80	100	20
100	120	19
120	140	18
140	160	17
160	180	16
180	200	**15**
200	225	14
225	250	13
250	300	12
300	350	11
350	400	10
400	500	9
500	600	8
600	700	7
700	900	6
900	1100	5
1100	1600	4
Over 1600		3

** Applicable only to private line telephone and telegraph services and channels and to foreign exchange services furnished by means of toll line facilities.

* A station shall be considered as "two-way" if arranged to originate communications. Extension or spare instrumentalities shall not be considered as stations.

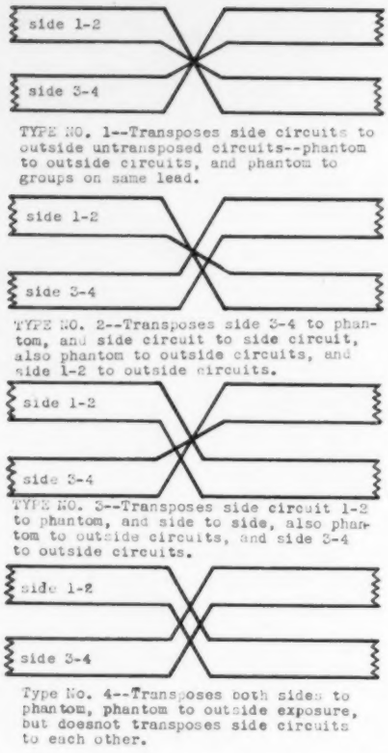

side 1-2
side 3-4
TYPE NO. 1--Transposes side circuits to outside untransposed circuits--phantom to outside circuits, and phantom to groups on same lead.
side 1-2
side 3-4
TYPE NO. 2--Transposes side 3-4 to phantom, and side circuit to side circuit, also phantom to outside circuits, and side 1-2 to outside circuits.
side 1-2
side 3-4
TYPE NO. 3--Transposes side circuit 1-2 to phantom, and side to side, also phantom to outside circuits, and side 3-4 to outside circuits.
side 1-2
side 3-4
Type No. 4--Transposes both sides to phantom, phantom to outside exposure, but doesnot transposes side circuits to each other.

Fig. 18—Effect of 4 Types of Phantom Transpositions.

A Simple 20-Wire Transposition Scheme.

Another transposition design involving a minimum of transpositions and which is suitable for a twenty-fire rural lead is shown in Figure 17.

Transposition Section Suitable For Phantomed Lines.

The phantom transposition in a telephone circuit serves the same purpose as a side circuit transposition; namely to reduce crosstalk to other sides and phantom circuits and at the same time to minimize inductive interference from power circuits. Because of the close relationship between the sides and phantom of the phantom group, it is necessary to have four types of phantom transpositions, all of which accomplish the same purpose, that is the transposition of the phantom circuit with respect to outside circuits. However, each type acts differently with respect to the transposition relationship of the side circuits. Figure 18 illustrates what is accomplished by each type of phantom transposition. Figure 19 illustrates how the wires are thrown on the transposition brackets for each type.

When phantom telephone circuits are carried on a rural lead, as for example a simple ten-wire line with two phantom groups, the system of transpositions shown in Figure 20 will work out satisfactorily.

Minimizing Inductive Interference

By
B. C. BURDEN
Transmission Engineer,
THE LINCOLN TEL. & TEL. CO.

Part III

The scheme shown is designed on the basis of transposing against crosstalk between adjacent telephone circuits, but leaving non-adjacent circuits on the lead untransposed. Due to the fact that circuits not closely adjacent can stand considerable parallel before objectionable crosstalk takes place, such a system as shown is permissible and saves a number of transpositions over the standard transposition schemes.

Illustration of the Balancing Effect of Power-Telephone Transpositions

● To give a better understanding of the effect of transpositions on transverse and longitudinal induced voltages, we have shown in Figure 21 four situations which are as follows:

1. No transpositions in either line.
2. A transposition in the telephone line but none in the power line.
3. A transposition in the power line but none in the telephone line.
4. Coordinated transpositions in power and telephone line.

The illustrations show voltages which are assumed to be induced in the two wires of the telephone circuit. It will be noted that the voltage induced in the telephone wire shown nearest the power wire is higher than the voltage induced in the wire farther away.

The algebraic sum of the voltages induced in each section of the telephone line is shown at one end of the line. **Obviously an arrangement producing both zero transverse and zero longitudinal voltages is desirable.** A circuit having a high longitudinal voltage and zero transverse voltage may result in considerable noise due to the normal unbalances (such as high resistance

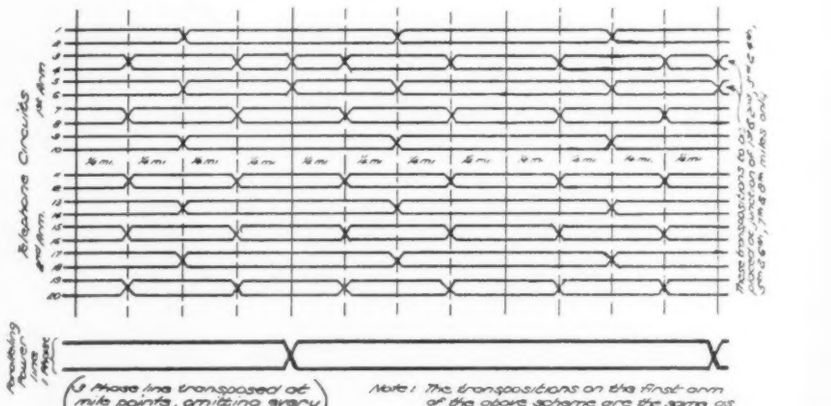

Telephone Circuits
Power Line
(3 Phase line transposed at mile points, omitting every third transposition.
Note: The transpositions on the first arm of the above scheme are the same as those shown for a 10 wire lead (See Bulletin #4) except for junction transpositions which are necessary when second arm is added

Fig. 17—Simple Transposition Scheme Suitable for 20-wire Rural Leads.

splices, ground leakage, etc.) inherent to most telephone circuits, especially those that are not properly maintained. A careful study of the four cases shown in Figure 21 should prove very helpful in giving a good understanding of the value of transpositions.

Phase of Induced Voltage in a Telephone Circuit with Various Transposition Arrangements of Power and Telephone Circuits

● As has previously been stated telephone transpositions or single phase power transpositions result in a **180 degree phase shift** relationship while three phase power transposition result in only a **120 degree shift.**

This means that on single phase power lines, we get neutralization of induced voltages with a single power transposition whereas in a three phase line, we must have two power transpositions in order to give the complete rotation of the several wires.

It is interesting to study the table of Figure *22* which shows the inductive phase shift which takes place due to either telephone or a power transposition and for both longitudinal and transverse induction and for both balanced and residual currents. To illustrate, how this table is used let us consider a single phase power circuit. Referring to the table it will be seen that neither a telephone nor a power transposition is effective in reducing or affecting the longitudinal voltage resulting from residual currents or voltages, however a telephone transposition is effective in reducing the transverse voltage as is shown by the fact that there is a 180 degree shift which takes place due to a telephone transposition.

Computation of Equivalent Untransposed Exposure

● For the telephone man who is called upon to solve inductive interference problems frequently, the following information which shows how a given power-telephone line parallel can be studied and the **equivalent untransposed exposure** computed may be interesting. If we have an existing parallel in which no effort has been made to coordinate power and telephone transpositions and we desire to study the parallel in an effort to determine how effective the existing transpositions are, there is a method whereby we can mathematically compute what has been termed the **equivalent untransposed exposure** for the combination of transpositions in the telephone and power circuits. The term "equivalent untransposed exposure" refers to the total length of an

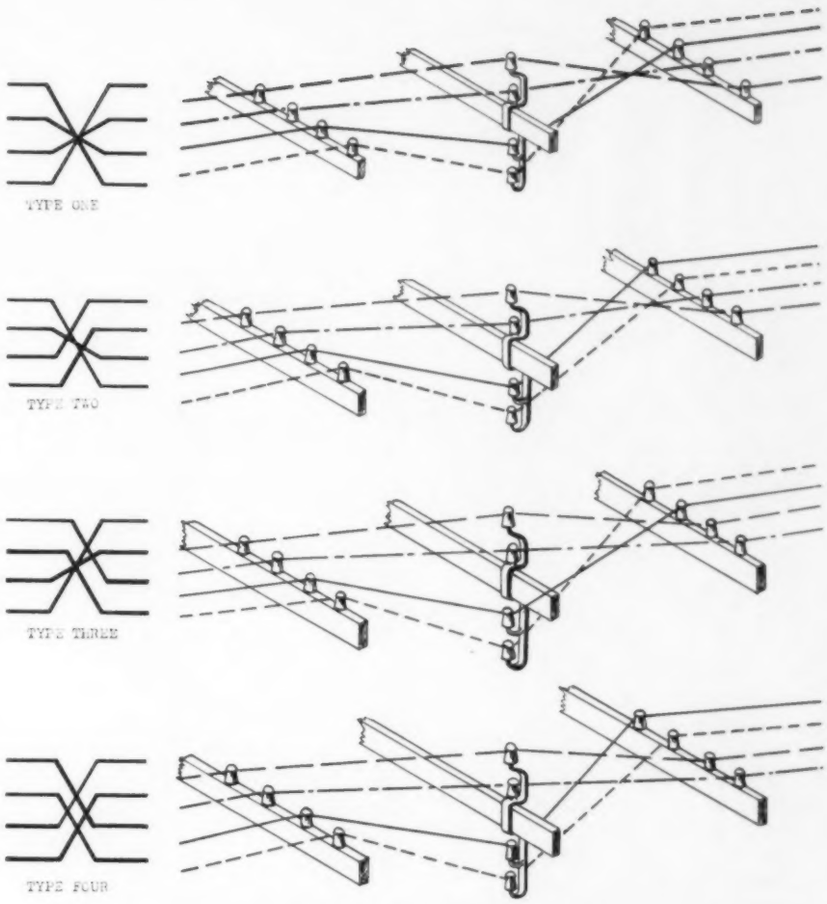


Fig. 19—Method of Making 4 Types of Phantom Transpositions.

untransposed power-telephone line parallel which should be equivalent (from a noise standpoint) to the specific parallel under consideration taking into account the value received from existing power and telephone transpositions. In an ideal well coordinated parallel this equivalent length would be zero.

Figure *23* illustrates in a specific par allel the significance of the term. In a study of single phase parallel, the method of computing the E.U.E. is very simple because of the 180 degree phase shift relationship which exists. It is only necessary to compare paralleling lengths of so-called **A** and **B** exposure, taking into account the so-called plus and minus sections of the telephone line to obtain the transverse balance of telephone line to power line. The longitudinal balance of power to telephone line is obtained by a comparison of the relative lengths of the A and B sections.

In applying this method it should be kept in mind that a **power transposition is not effective in reducing longitudinal voltages due to residual currents and voltages.**

(Please turn to page 32)

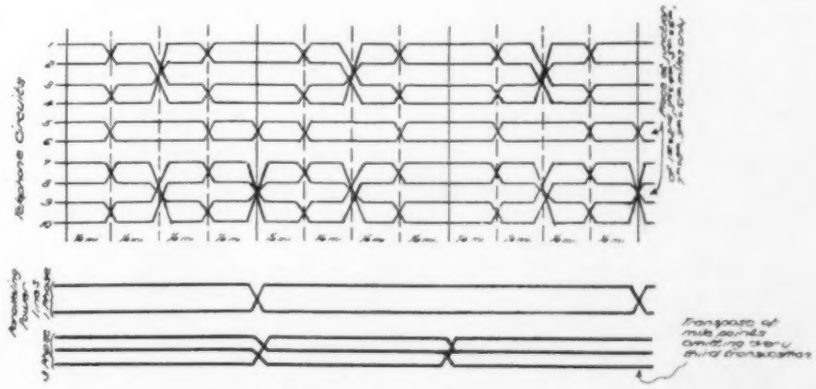
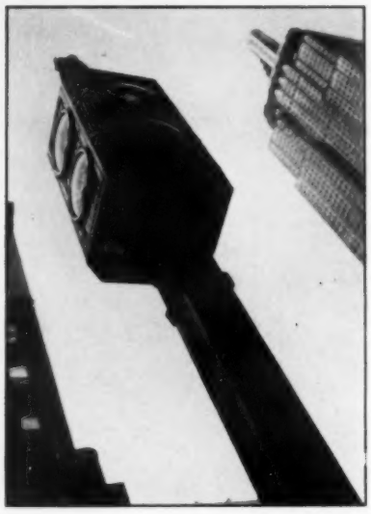


Fig. 20—Transposition Section Suitable for Phantomed Lines whose Total Length is not over 12 Miles.



Colorize

Act VII of

Showmanship in Business

by

ZENN KAUFMAN

RED and Green! Stop and Go! When the light at the corner turns red—you stop! When it turns green—you go! Twenty million motorists take these signals for granted every minute of the day—and so do the railway engineers who are guardians of the two hundred million passengers on railroad trains, entrusting their lives to the blinking lights that signal danger and safety to speeding trains.

But color signals do much more than direct traffic. Black signaled death in London where Blackfriars Bridge was a favorite suicide spot. Police repainted it green, last year, and—according to READERS' DIGEST — the suicide rate was cut by a third. Black signaled death, but green signals life. The DIGEST also tells how magenta lights at a party are better than two cocktails. Magenta signals romance, making men more gallant as women appear more youthful and glamorous.

● Color association is a tremendous force in our lives. In business, too. In many cities, the classified advertising directory is referred to always as the "Red" Book. In other cities we turn automatically to the "yellow" pages of the 'phone books to locate businesses by classification. The public recognizes filling stations, candies, soaps, trade marks by their standardized coloring. But the association must be checked carefully back to the goods themselves. A candy manufacturer readily sold his merchandise when he wrapped it in red paper. His sales had been few when it was boxed in a blue package. One color expert found that certain colors that increased sales in a low-priced field decreased sales in high-priced fields. For example, a red-handled toothbrush sold well. But who except the fire chief would buy a really red automobile?

● Air sickness was reduced definitely by redesigning the interior color scheme of airplanes. Further, they took off the menu certain foods that had unpleasant color values. The English and the Irish will respond quickly to blues, greys and greens; the Germans and the Dutch like reds and oranges. National preferences in color are sometimes very important. In China, for example, white is the color of mourning.

Fred Rahr nearly doubled the business of the CERTAINTEED products company by "colorizing" their whole business. First, he redesigned their product—a roofing shingle—in new and brighter colors. He hired a crew of college men and sent them out in a fleet of ten rainbow colored automobiles. Cooperating with the local building supply dealer, the fleet would anchor at the door of an industrial plant at lunch time and as workmen streamed out—they would find the road covered with rows of beautiful shingles. At Binghamton, New York, where they started, one hundred and twenty-eight leads were secured resulting in and always at prices higher than existing competing levels. Further publicity was obtained by night installations with flood lights.

● Near Salt Lake City is an ordinary lumberyard. The owner of that lumberyard had an idea. His name is Green; he painted the fence green, wore green socks, green suit, green tie, green hat, got the telephone company to break one of their rules and put a "Green" prefix to the number, used green ink, and then advertised himself "GREEN FOR LUMBER—when you think of GREEN'S, think of LUMBER. He did a great business. Then there is a printer in Salt Lake City doing things no other printer has ever done; in his print shop the girls wear smocks —they change the color every week. Every desk is painted a different color —pink, blue, purple, green, yellow. You may go out fearing you are goofy but you never forget the plant!

Certain combinations of color in stationery and enclosures in direct mail selling are also found to sell better than others. Pink and canary outpull corn and white by three to one. Harper & Bros., publishers of "SHOWMANSHIP IN BUSINESS" (plug), tell me that cherry colored reply cards outpull any other color from ten to twenty percent. Put color into your envelopes and stationery enclosures. If you can't afford to buy color, buy little gummed labels which only cost 50c per thousand and can be printed in red or in blue.

● The newspapers are making big progress in putting color into daily advertising. Magazines find that ads in color are many times more effective than black and white. Take the hint—use color in your direct mail advertis-

(Please turn to page 38)

FREE: Your copy of THE SHOWMANSHIP YARDSTICK is still available. Just send us a self-addressed stamped envelope and we'll return this valuable check list of showmanship elements.

Acknowledgment is made to Harper & Bros. for permission to reprint parts of SHOWMANSHIP IN BUSINESS by Kenneth Goode and Zenn Kaufman.

Local Test Desk Operation

PART VII

By C. F. CURTISS

IN ORDER that the various electric currents, such as ringing current battery current, coin collector current and etc., used in the operation of a telephone system may function properly, the parts of a subscriber's line circuit across which the applied electromotive force exists should be well insulated from each other to prevent loss of the electric current as leakage, or a possible complete breakdown in the form of a short circuit or ground. The higher the applied voltage between the conductors of a telephone circuit, the better the insulation must be.

● It usually is a comparatively simple matter to insulate the circuit conducting wires in air by suitable separation, as for example, supporting bare copper wire on glass insulators attached to wooden pins affixed to cross arms. However, when the conductors of necessity lie close together, the problem is more difficult. Where the insulation is poor, generally the result of aging, an appreciable leakage of current develops, often to such a degree that the insulation fails and a breakdown occurs. The aging of the conductor insulating material is caused by the combined effects of vibrations, of volatilization of certain elements of composition, and absorption of moisture and other injurious elements from the surrounding air. All of these are aided by expansion and contraction due to temperature changes.

● In the majority of cases the insulation round a conductor is more or less imperfect, which as previously stated means that a certain leakage of current actually flows from conductor to conductor through the separating insulation whenever telephone operating current voltage is applied to the circuit. The resistance offered to this leakage path is called the insulation resistance between the conductors, that is, it is the electrical resistance offered to an impressed voltage to produce a leakage of electric current.

There is also a certain leakage current which flows to earth from the positive line conductor and from the earth to the negative line conductor the resistance of these paths being called the insulation resistance to the earth from the particular line conductor concerned.

Insulation resistance may be separated into two components, volume resistivity, and surface resistivity. The former is said to be the leakage path through substance or interior of the insulation, while the latter electrically in parallel with the former, is the surface leakage path composed of a film of moisture or other foreign matter on the surface of the insulating material.

● Practically all insulating materials or decreasing resistance with rising temperature. By temperature coefficient is meant a coefficient of variation in quantity, per degree of change in temperature. That portion of the leakage current which flows through the insulation is, for most practical purposes, negligable as compared with that through the surface film. Insulation materials containing appreciable moisture have a decreasing volume resistivity with increase of applied voltage. In all such material, the volume resistivity increases rapidly as the moisture is dried out.

Telephone lines which are built at the same time and under the same construction conditions may have high insulation resistances but different in

Chart showing reading in megohms on a test desk 100000 ohm direct current voltmeter of 75, 120, and 150 volts respectively.

VM Needle Across The Scale	75V 100000 W Voltmeter with 75 Volt Test Battery	120V 100000 W Voltmeter with 100 Volt Test Battery	150V 100000 W Voltmeter with 150 Volt Test Battery
No. Divisions	Resistance In Megohms	Resistance In Megohms	Resistance In Megohms
1	7.40	9.90	14.90
2	3.65	4.90	7.40
3	3.40	3.23	4.90
4	1.76	2.40	3.65
5	1.40	1.90	2.90
6	1.15	1.56	2.40
7	0.97	1.32	2.04
8	0.84	1.15	1.80
9	0.62	1.01	1.56
10	0.60	0.90	1.40
11	0.58	0.89	1.26
12	0.53	0.73	1.15
13	0.47	0.70	1.05
14	0.43	0.62	0.97
15	0.40	0.57	0.90
16	0.37	0.53	0.83
17	0.34	0.49	0.49
18	0.31	0.46	0.73
19	0.30	0.43	0.69
20	0.27	0.40	0.65
21	0.25	0.38	0.61
22	0.24	0.35	0.58
23	0.22	0.33	0.55
24	0.21	0.31	0.52
25	0.20	0.30	0.50

CHART NO. 1

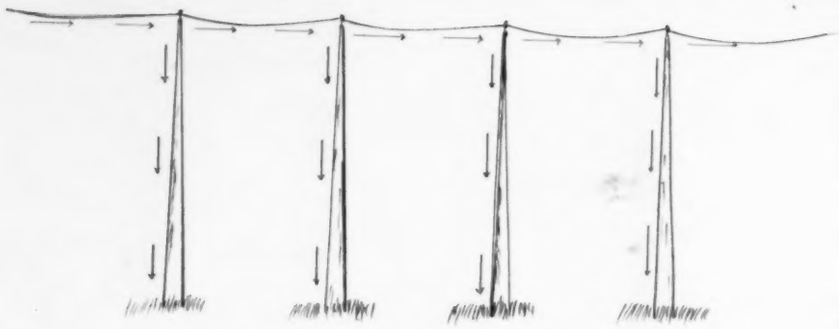


Fig. 1—Arrows indicate direction current is flowing along line wire and leakage to earth.

value. However, a high value of line insulation resistance does not necessarily give assurance that the entire insulation is in good condition and free from defects, which eventually may cause a telephone service failure. A line that has a relatively low insuldielectric strength to operate satisfactorily for a long time.

● When dealing with the resistance of a telephone line circuit what is known as "true" and "apparent" insulation and conductor resistance should be considered the true insulation resistance is the combined resistance of all the paths where current can escape between the conductors or to the ground. The true conductors or the ground. The true conductor resistance is the resistance of the wire itself. The apparent insulation resistance is always cheaper and the apparent conductor resistance is lower than their true value.

The insulation resistance of a telephone line circuit is measured by various methods, the most common practice being by means of a high resistance voltmeter. For example, consider a voltmeter having a scale range from 0 to 100 volts, and graduated in divisions of one volt. It's resistance at 1000 ohms per volt would be $100 \times 1000 = 100{,}000$ ohms. With the meter connected to a 100 volt test battery and a telephone line circuit, the maximum resistance that ca nbe measured when in in series with the voltmeter would depend upon the least part of a scale division which could be read by the test man. In addition to this, it may be said that the precision obtainable in any of the measurements made at the local test desk depends upon the various factors which enter into the determination of desired results, among these are thecorrectness of the principal employed and method used, accuracy of the instrument, number and magnitude of possible errors, correctness of calculations and etc.

● Figure I illustrates a pole lead and line wire attached to insulators along which a current is flowing and owing to damp weather a small amount of the current leaks to the earth from the wire to the glass insulator, it's supporting pin and along the damp pole surface to the earth. Figure 2, is a graphical representation of the condition shown in Figure 1 and shows the connection to a test battery and voltmeters for making an insulation resistance measurment to ground. The test desk voltmeter is connected in series with the line and insulation being measured. The insulation being in series with the voltmeter acts like a multiplier, that is, the drop in voltage across the insulation is proportional to it's resistance. From the diagram it will be noted that the several leaks to earth are distributed along the entire length of the line wire and consequently forms a series of parallel paths for the current. Assuming a reading of 1.5 scale divisions are obtained, then by formula the I.R. (insulation resistance) is $\text{I.R.} = \frac{\text{E}-\text{D}}{\text{R}}\,\text{VR}$ or $100 - 1.5 = 98.5/1.5 = 66 = 100{,}000$ 6600000 ohms. In the formula "E" equals the test battery voltage, "D" is the number of scale divisions to which the voltmeter needle is deflected, and "V R" the voltmeter resistance. If the insulation of the line wire were perfect no reading of the voltmeter would have been obtained.

● Standards for comparison of the insulation of various lines have been established on the basis of a line a mile long, and calculations are therefore ordinarily made to obtain the insulation per mile directly, rather than the actual insulation of the particular length of the line measured. The insulation resistance of a line five miles long for example will only be one fifth of a similarline one mile long. The insulation per mile of a five mile line will be five times the actual insulation of the line, and on a line "L" miles long will be "L" times the actual insulation. Consequently, to obtain a comparison, the insulation obtained by the test is multiplied by the length of the line in miles, the result being given in megohms per miles. One megohm equals 1,000,000 ohms. The complete formula for determining insulation resistance of a line when using a voltmeter to make the measurements is $\text{I. R.} = \frac{\text{E}-\text{D}}{\text{D}}\,\text{VR}$, and will be in terms of insulation per mile $\text{I. R.} = \frac{\text{E}-\text{D}}{\text{D}}\,\text{VRL}$, where "L" equals the length of the line in miles, and expressed in megohms the formula becomes $\text{I. R.} = \frac{\text{E}-\text{D}}{\text{D}}\,\text{VR} \times \frac{\text{L}}{1000000.}$

The insulation resistance of a line wire (joint resistance of all the leakage paths) in ordinary weather should be several megohms per mile. Chart 1 shows the insulation resistance in megohms corresponding to each scale division deflection up to 25 of an 75, 120, and 150 volt 100,000 ohm voltmeter respectively. The value given in meg-

Figure 2

ohms obtained from the chart must be multiplied by the length of line circuit to obtain the insulation resistance per mile. In using the chart it is very impor-

(Please turn to page 39)

Safety First Advice and Thought

By B. E. Hardin

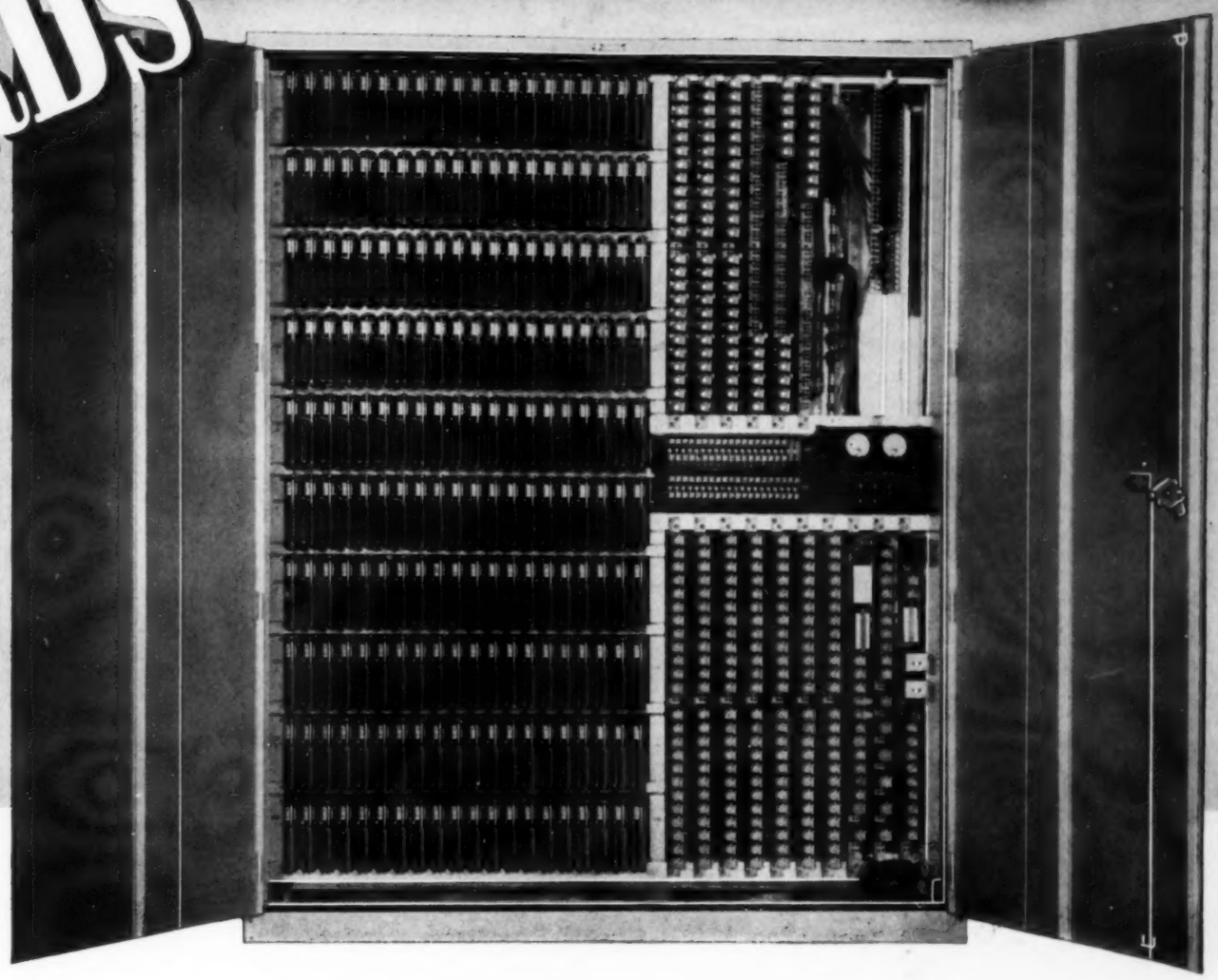
In the past few years telephone and power companies have been employing new men. When employing new men it calls for a careful selection on the part of the management in selecting men suitable for these jobs. In selecting men to be employed it is best to get strong healthy one's that will make good and careful workers.

When new employees come on the job it is the duty of the older employees to teach them to be careful. They should cooperate with their fellow workmen in their day to day duties, and do good and safe work at all times.

Older employees in these fields should always assist their supervisor in seeing that the day to day jobs are safely carried out; for the benefit of their fellow workers as well as the public around them.

It is the duty of every employee to make their deposits in the bank that pays 100 per cent. This is the bank of safety first, last and always.

RDS



relay automatic service to small exchanges, and are characterized by the same dependability, economy and trouble-free operation for which Automatic Electric equipment has been noted for over forty-five years.

When you select automatic equipment for your small exchanges, remember that nowhere today can you match the accumulated experience of this organization, which now has over 600 small automatic switchboards of its manufacture installed and in daily operation. Whether you prefer relay or switch type apparatus, specify Automatic Electric and be sure of maximum economy and lasting satisfaction.

Automatic Rotor Relay Switchboards are enclosed in compact, neatly finished, dust-proof steel cabinets. Installation is simple, requiring only the connecting of the line cables, trunk cables and power wiring. The switchboard shown above has a capacity of 100 lines.

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AND SIGNALING PRODUCTS

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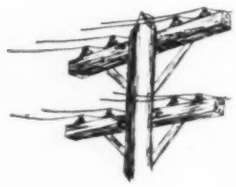
LONG LINES

R. A. Clark, Jr.



Power System Communication

The development of interconnected power transmission lines and generating stations during the past fifteen years has been dependent wholly on a reliable communication system. Without instant communication between the dispatcher and the generating stations, distribution stations and load centers it would be impossible to maintain reliable and continuous power service.

The modern power system of today consists of several generating stations each ranging from about ten thousand to five hundred thousand kw capacity, interconnected by means of high voltage transmission lines either 66 or 132 kv with distribution substations tapped on at strategic points generally in the center of a large load area. At these distribution stations the voltage is transformed down to about 33 kv at which voltage power is distributed to smaller load centers such as cities and large industrial customers. Often there will be two or more 33 kv lines over which power may be supplied to the substations. The 33 kv substations take the place of the old small and inefficient generating plants originally located in each city.

The operation of the power system is in charge of a load dispatcher who is generally located near the geographical center. He has direct telephonic communication to all of the generating stations and to important distribution substations. At large distribution points an operator is generally in charge throughout the twenty-four period. At the smaller points only a lineman is available who maintains the equipment and operates the necessary switches during circuit changes or in times of trouble. The operators at the generating plants and substations report to the dispatcher at frequent intervals, generally every hour. When trouble develops, the section of line in which the failure occurs must be opened at the switching points adjacent to the fault and power supplied to the customers over other lines. In order that the outrage may be minimized the dispatcher must be able to communicate with the substation operators on each side of the fault and establish a party line type telephone circuit. This is essential in order that all parties involved can tell what is going on. Sometimes when serious faults develop, as many as six or eight operators will be involved all of whom must be able to talk with each other.

Inasmuch as communication between the dispatcher and substations must be established before any switching operations can be performed, the telephone system must be as reliable and foolproof as possible. The circuits commonly used consist of both privately owned and telephone company lines each system being complete in itself. All of the lines are generally terminated in a switching cabinet similar in design to the cordless type magneto switchboard. The substation operators also have a small switching cabinet in which the lines terminate. In many cases the telephone company circuits can be connected to the power system communication lines so that either may be used in any section. This permits wide flexibility of interconnection in case of trouble on either the power company or telephone company system.

The dispatchers switchboard is gen-

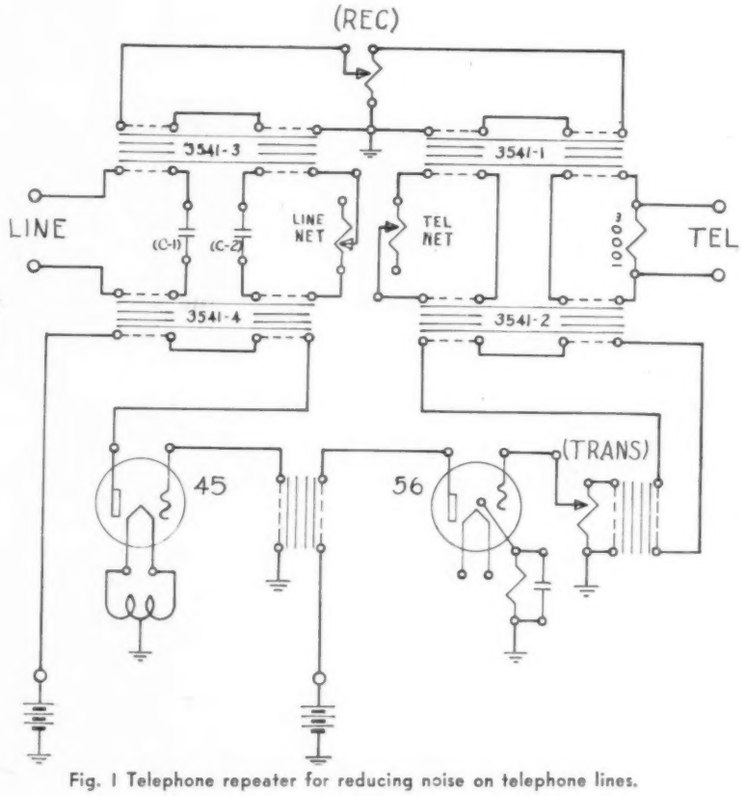


Fig. 1 Telephone repeater for reducing noise on telephone lines.

erally built in two or more sections so that the work may be divided among several dispatchers especially during emergency conditions such as occassioned by storms or other sources of trouble.

With regard to the types of circuit required for satisfactory power dispatching communication, the local battery ring-down circuit has proven most reliable. The dispatcher generally has a source of power ringing with a hand generator for emergency. Storage batteries with a trickle charger are used for the transmitter. Similar installations are provided in the larger substations; in the smaller ones dry batteries and hand generators are used. The circuits used to interconnect the telephones are generally metallic copper or equivalent. Carrier-current communication over the power lines is used quite extensively and has proven very reliable. However, the cost has in general restricted its use to the higher voltage lines.

The problem of noise and protection is very important on metallic lines owing to the fact that the telephone circuits are generally constructed underneath the 33 KV transmission lines. Even with transpositions installed every second or third pole the noise level is quite high. A scheme which has proven very satisfactory for reducing the noise is shown in Figure 1. This consists of a modified telephone repeater in which the outbound voice is amplified from about ten to fifty times and the inbound signal dropped about the same amount. In so doing the voice energy over-rides the noise which in effect reduces the interference. By using such an amplifier at each telephone the noise can be cut down to as much as 10% of its initial value. At the same time the voice equivalent of the circuit can be improved from five to ten db.

As the ringing signals will not pass through the amplifier the generator and bell must be connected directly to the line. In some cases this is not practical and a ringing repeater therefore becomes necessary. This permits either cutting the line through during the ringing period or increasing the ringing signal by means of a ringing source at the repeater.

The protection of telephone equipment and the operators during faults on the power system is of first importance as high voltage may be either induced on the telephone line when a power fault occurs, or result from direct contact with a falling power wire. The type of protection commonly used consists of an isolating transformer interposed between the telephone equipment and the line together with suitable fuses and arresters. The transformer should be capable of withstanding the full voltage which might result from contact with a power conductor. The transformer and protectors are connected as shown in Figure 2.

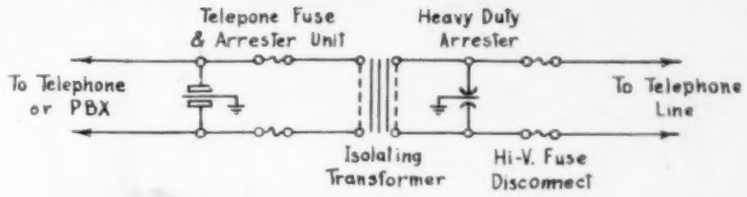


Fig. 2 Protective equipment for telephones on circuits under-building high-voltage power lines.

A recently developed device which has considerable possibilities in reducing acoustic shock and equipment failure from surges is a so-called "stick relay" the winding of which is in series with a low voltage arrestor. This unit is connected across the line side of the isolating transformer and operates to both short circuit and ground the telephone line when a high voltage surge occurs. The relay winding is capable of passing several amperes continuously and will therefore give protection against accidental contacts or abnormal induction of long duration.

There has been some hesitancy on the part of telephone companies to connect their equipment to switchboards in which the power company owned lines are also connected. This undoubtedly has been due to fear of possibility of high voltage passing through the switchboard into the telephone company plant. However, experience has indicated that this fear is not justified; with the protection most power companies require for their own use the possibility of high voltage reaching the switchboard is extremely remote. Much progress has been made in the past few years toward reaching an understanding of the problems each company has and the cooperative efforts are resulting more and more in higher grade service to the power companies.

Tennessee Independents Meet

The Tennessee Independent Telephone Association meeting held in Nashville on October 25 and 26 has been reported by Mr. Chas. C. Deering, Louis Pitchcer and other prominent telephone men who attended this convention as being one of the outstanding meetings of the South. This Association is only three years old but according to the attendance and the interest manifested in the program and the exhibits made by the various manufacturers, it is growing and will soon take its place among the leading state associations of the country.

Mr. A. U. Meadows, Assistant to the President of the Inter-Mountain Telephone Company was elected President and B. H. Piepmeier, General Manager of the Southern Continental Telephone Company of Cookeville, Secretary- Treasurer.

At the Nashville meeting, addresses were made by Louis Pitcher, C. C. Deering, Dr. W. B. Boyd, director of State Information; Hon. Albert Gore, Commissioner of Labor; and Alfred L. Geiger, general counsel of the National Association.

The meeting was brought to a close Tuesday, at noon with a banquet and all left with renewed enthusiasm for the new Association.

We are informed by Mr. B. H. Piepmeier, Secretary-Treasurer of the Association that many new members have joined the State Association and prospects for 1938 are very good and much work is ahead for the Association in helping every active member.

Stewart Leads Georgians

Holding a 2 day meeting at Atlanta during November, the Georgia Independent Telephone Association selected the following officers: A. N. Stewart, Fitzgerald, president; A. A. Fincher, Canton, 1st vice president; W. A. Echols, Commerce, 2nd vice president; and Homer J. Wright, Dawson, secretary-treasurer.

The association, representing 174 independent exchanges in Georgia, went on record as opposed to any increase in the state utility tax during the extra session of the Georgia legislature.

Minnesota Convention in January

Secretary J. C. Crowley, Jr., of the Minnesota Telephone Association is in the midst of preparing for another great convention at the Radisson Hotel, Minneapolis, January 25-27.

Indications point to even a larger attendance than was recorded at the last convention held in January. Invitations are out and a number of manufacturers have already made arrangements to exhibit during the 3 day meeting.

Line and Desk

RAY BLAIN, Member A.I.E.E., Editor

Q. How can a short length of cable be supported best between buildings on block cable construction.

A. On very short distances an iron pipe is often used to advantage. Ordinarily though a 600 pound messenger strand is used on the small type cable generally used on this type construction.

Q. What is residual magnetism as referred to in a telephone relay?

A. This is the magnetism which is retained by the core of an electric magnet after the circuit has been broken.

Q. What is the difference between an individual telephone line and a private telephone line?

A The individual line is usually referred to is a one party line connecting direct to a central switchboard. The private line in the usual sense is one without any switchboard connection and each subscriber can talk only to the subscribers on their own line.

Q. When may telephone loading coils be used to advantage in the plant?

A. They may be used on cable circuits between toll centers; on either side circuits or phantoms. Also on toll entrance or intermediate cables and inter-office trunk cables, either automatic or manual. Loading coils may also be used to advantage on long subscribers loops in cable.

Q. What is the radio suppressor type dial and how is it used.

A. This is used to prevent the broad casting of dial impulses to nearby radio receiving sets. This dial is equipped with a .1 MF condenser and a two-winding radio frequency choke coil. This equipment is mounted inside the dial and connected to the impulse springs to absorb the arc.

Q. We are having considerable noise trouble on our operators headsets and appreciate advice as to how it may be prevented.

A. Cords should be tested and if found noisy replaced at once. The transmitters may be defective and require replacing. Operators often ruin their headsets by dropping them frequently. This often occurs when the night operator lays headsets on the key shelf instead of wearing them continuously. If properly they should give long service without noise or trouble.

Q. Is liquid wax considered suitable for treating battleship linoleum covered floors in the switchboard and terminal rooms.

A. Liquid wax is considered highly desirable for this purpose and it is much easier to apply than the paste wax. The treated surface is hard, glossy and impervious to the penetration of dust Neither will the surface show smears and tracks as is often the case with paste type wax.

Q. What type of automatic charging of telephone storage batteries is recommended for maximum life and service?

A. There are several different methods of automatic charging of telephone storage batteries and they are all considered good. These systems maintain the battery at near full charge at all times regardless of the fluctuations in the discharge rate. When the rate of discharge is increased the charging rate automatically increases.

Q. What is the oil-dashpot relay and how is it used in a circuit?

A. This is a relay which is used where there must be an adjustable operating delay of seconds or minutes between the closing of the coil circuit and the operation of the contacts. Operating speed is adjusted by turning the dashpot cylinder, which controls a needle-valve inside to limit the oil flow. Release is almost always quick acting.

Q. What type tool can be best used for cutting asphalt pavement when a regular compdessed air hammer is not available?

A. We would recommend the use of a portable gasoline hammer. This is a two-cycle, single cylinder, hard hitting gasoline driven hammer ruggedly built and strikes approximately 1500 blows per minute. This machine is self contained except for the battery and coil box which is connected to the hammer with a small cable.

Q. Is it permissable to attach two guys in the one eye of an anchor rod?

A. Many do not consider this good practice on a noble eye unless the guys take off at an angle so that the thimbles pull free from each other. Some of the thimble-eye guy rods are made so as to accommodate, one, two or three separate guys.

New Schedule For Bell Special Service

(Continued from page 17)

ent company will be justified in making a lower rate and the extra line mileage outside the exchange area should in no case exceed the regular Bell rates for similar service.

The officers and the Committee are highly gratified at the fair way in which the American Telephone and Telegraph Company, represented by Mr. Bickelhaupt, Assistant Vice President, has met the requests of your Association. We consider this new schedule of rates as a real accomplishment on behalf of the Independent industry. The Committee on Special Services will continue its work during the coming year.

Very truly yours,

U. S. Independent Telephone Assn.,
(SIGNED)

J. H. Agee,
President.

In case of foreign exchange service the foreign exchange and the customer's station are each counted as a station.

No commissions to be paid a Connecting Company where its charge for facilities to the point of connection with Bell System facilities is applied, that is, where the charge to the customer for such service is on an "other line" basis. If another Connecting Company commission to the latter Company to is involved in the same service, the be based on the total Interexchange Channel and Drop charges, excluding the charges and number of stations on the "other line" basis.

No commission to be paid Connecting Companies where Connecting Companies furnish all the toll line facilities and are paid the total Interexchange Channel and Drop Revenues received from the customer.

Where a Connecting Company is compensated for line facilities on a prorate basis, the total commissions will be deducted from the Interexchange Channel and Drop service revenue before prorating. The commission to be determined as follows:

(a) Associated Company Contracts. On the basis of the above schedule for each Associated Company and Connecting Company station.

(b) Long Lines Contracts. On the basis of the above schedule for each Connecting Company station and the Long Lines-Associated Company Schedule for each Associated Company station.

Wire Rope and Strand

now products of Bethlehem

WITH the recently-announced acquisition of Williamsport Wire Rope Company by Bethlehem Steel Company, Bethlehem becomes a manufacturer of wire rope and strand.

For years the name Williamsport has been identified with dependable wire rope and strand. Not only to men who have been using Williamsport products, but to all other wire rope and strand users, Bethlehem's entry into this field marks an important forward step.

As Williamsport Wire Rope becomes Bethlehem Wire Rope, customers of Williamsport Wire Rope Company can look with assurance to Bethlehem to maintain the quality standards associated with Williamsport products. Advantages to the user may naturally be expected to accrue from the broader manufacturing and servicing facilities offered by the Bethlehem organization.

Customers of Bethlehem Steel Company can now obtain a complete line of wire rope and strand from the same source which furnishes their other steel requirements, and made to the same quality standards as those that govern in the manufacture of Bethlehem alloy and tool steels, plates, sheets, and other products.

Wherever and however you use wire rope and strand you will find Bethlehem a source of well-made, dependable material, serviced by men whose long, first-hand experience in analyzing and solving wire-rope problems is a background for authoritative recommendations on the most suitable grade of Bethlehem Wire Rope for any task.

BETHLEHEM STEEL COMPANY

Cemetery at Balleau Woods

A Pioneer Reports On Europe

By P. KERR HIGGINS

● Our route took us south through Aussig and Teplitz, one of the famous spas to Prague (Praha), the capitol. The Elbe Valley is very beautiful, especially in blossom time. This part of the country is called the "Paradise of Bohemia" (Cesky "Raj"). We found in and near Teplitz some very hilly country, picturesque spots, ruins of old forts and historical monuments. Owing to its favorable geographical location (especially the high Tatra) sheltered from the north winds and open to the south, the climate is very mild. Prague has nearly a million population and is practically on both banks of the Moldau. The commanding point is the Fortress of Prague, around which the City is built. Several beautiful bridges span the River Moldau. It is a very historical City and most interesting to tourists and has a splendid town center. It was destroyed by fire in 1541. The Prussians occupied it in 1866. Prague became the capitol in 1918. The old town makes an interesting tour, especially the former Ghetto with its old synagogue and cemetery, 600 A. D. See illustration.

● There were beautiful old town buildings, with a unique astronomical clock, dating back to 1490. Also a Jesuit Monastery of huge dimensions, Houses of Parliament, Charters Bridge, another Gothic Stone bridge over the Vltava River, Castle of Prague, Cathedral with two tons of silver in its altar and small, quaint houses formerly occupied by the castle archers. There is also in Prague the Castle of Queen Anne and the dwelling house of Ludwig Van Beethoven and Casanova's home.

While in Prague we had a "Bombing Rehearsal," very much like the real article. The city was under martial law from 10:00 o'clock a. m. until 10:00 o'clock p. m. In the day time, no one was allowed on the streets and at night no lights of any kind were permitted in the houses or hotels. On the streets, all city lights were out, and the street cars and autos had their lights overed with blue cellophane, while over the city the Bombers flew very rapidly, dropping blank aerial bombs—a realistic spectacle of what might happen during a conflict.

The largest Terrace Restaurant in central Europe is located in Prague. This city at one time was the capitol of the "Holy Roman Empire," the home of John Huss the Reformer, the Czech Bretheren and the scene of the thirty years' war.

● At our hotel, there were two very interesting **dwarf** pages, one eighteen years old and one twenty-eight years old. The younger one was really a handsome little chap, with nice features and a well formed, attractive hand.

Prague is truly a city well worth seeing. But we had to be on our way again to Germany via Eger, Pilsen (founded in 1272) and Karlsbad (Karlovy Vary). At the Pilsner Brewery, there is a walk of five miles through rock-hewn cellars and tourists are served sandwiches (ham and rolls) and unlimited glasses of their famous beer. The well known Skoda Munitions Works are located here.

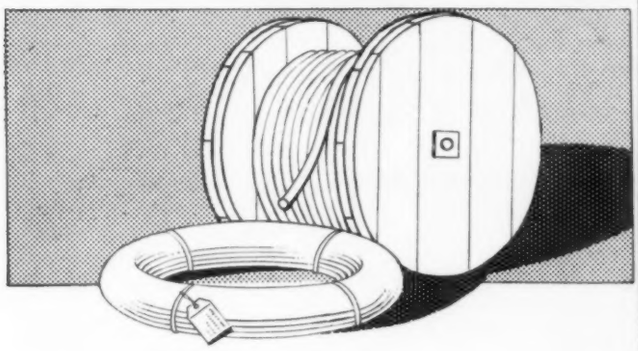
Karlsbad, the famous watering place, has a population of twenty thousand, and is charmingly located in the beautiful Tepi Valley. Karlsbad is, of course, a mecca for tourists from everywhere. The earliest mention of this town is in 1325 and the Castle was built in 1358. Goethe visited here twelve times, according to the records. There are a number of fine bathing pavilions,all in use. Auto drivers are not allowed to smoke at the wheel in Czecho Slovakia and they pride themselves on their low accident record.

● We crossed the border near Eger (Cheb) via Bayreuth, the town of Wagner.

(TO BE CONTINUED)

Fort of Vaux. Commemorative plate is for Capt. Tabourot who was killed as a hero at this spot.

PHILLIPS



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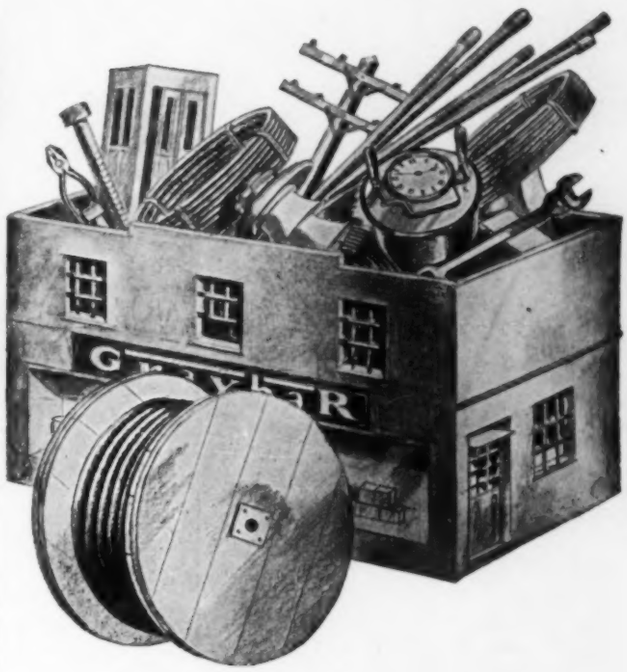

Cable

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But that's not all. Out of its roster of 60,000 electrical items, Graybar is prepared to meet *any* need of a telephone industry. And behind *every* Graybar item stands the Graybar reputation for quality that goes back 69 years.

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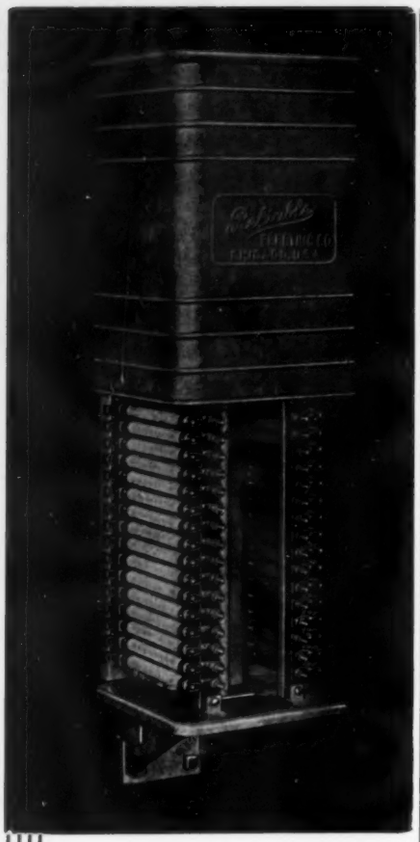

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Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
1345 CARROLL AVENUE - CHICAGO ILLINOIS

Minimizing Inductive Interference

(Continued from page 19)

Computing Unbalanced Exposure for Three Phase Lines

● In computing the equivalent untransposed exposure for three phase parallels the inductive relationship is more complicated due to the 120 degree shift at each power transposition, therefore, it is necessary that the various sections of line be combined algebraically (rather than by simple arithmetic). In order to simplify the method, the form shown in Figure 24 may be used and the several steps carefully followed which will give an answer in terms of the equivalent untransposed exposure.

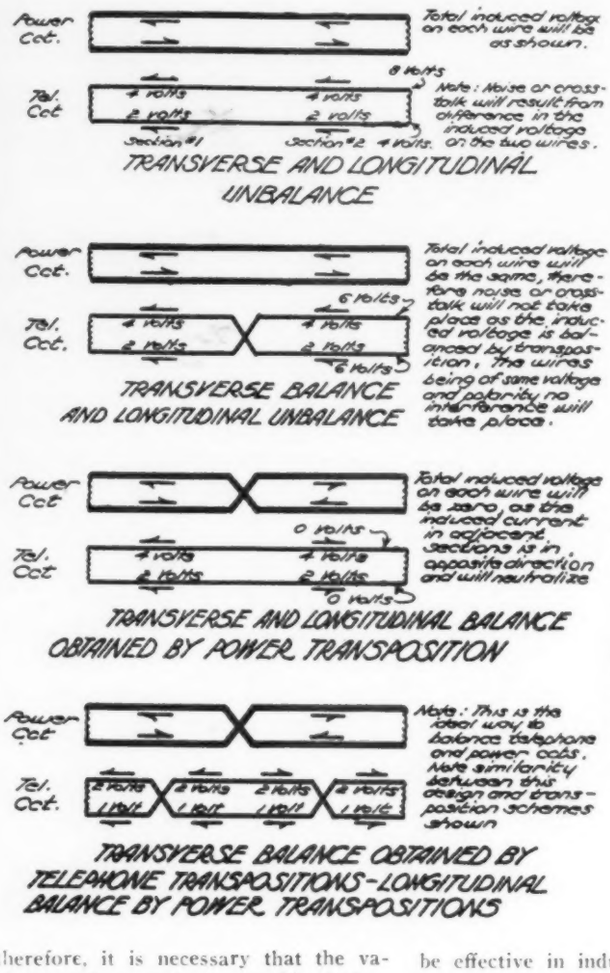

Power Cct.
Total induced voltage on each wire will be as shown.
Tel. Cct
4 volts
2 volts
6 volts
Note: Noise or cross-talk will result from difference in the induced voltage on the two wires.
Section #1
Section #2
4 volts.
TRANSVERSE AND LONGITUDINAL UNBALANCE
Total induced voltage on each wire will be the same, therefore noise or cross-talk will not take place as the induced voltage is balanced by transposition, the wires being of same voltage and polarity no interference will take place.
TRANSVERSE BALANCE AND LONGITUDINAL UNBALANCE
Total induced voltage on each wire will be zero, as the induced current in adjacent sections is in opposite direction and will neutralize
0 volts
TRANSVERSE AND LONGITUDINAL BALANCE OBTAINED BY POWER TRANSPOSITION
Note: This is the best way to balance telephone and power ccts. Note similarity between this design and transposition schemes shown
2 volts
1 volt
TRANSVERSE BALANCE OBTAINED BY TELEPHONE TRANSPOSITIONS - LONGITUDINAL BALANCE BY POWER TRANSPOSITIONS

Fig. 21 — Transverse and Longitudinal Relationship Between Single Phase Power Lines and a Telephone Circuit for Various Transposition Arrangements.

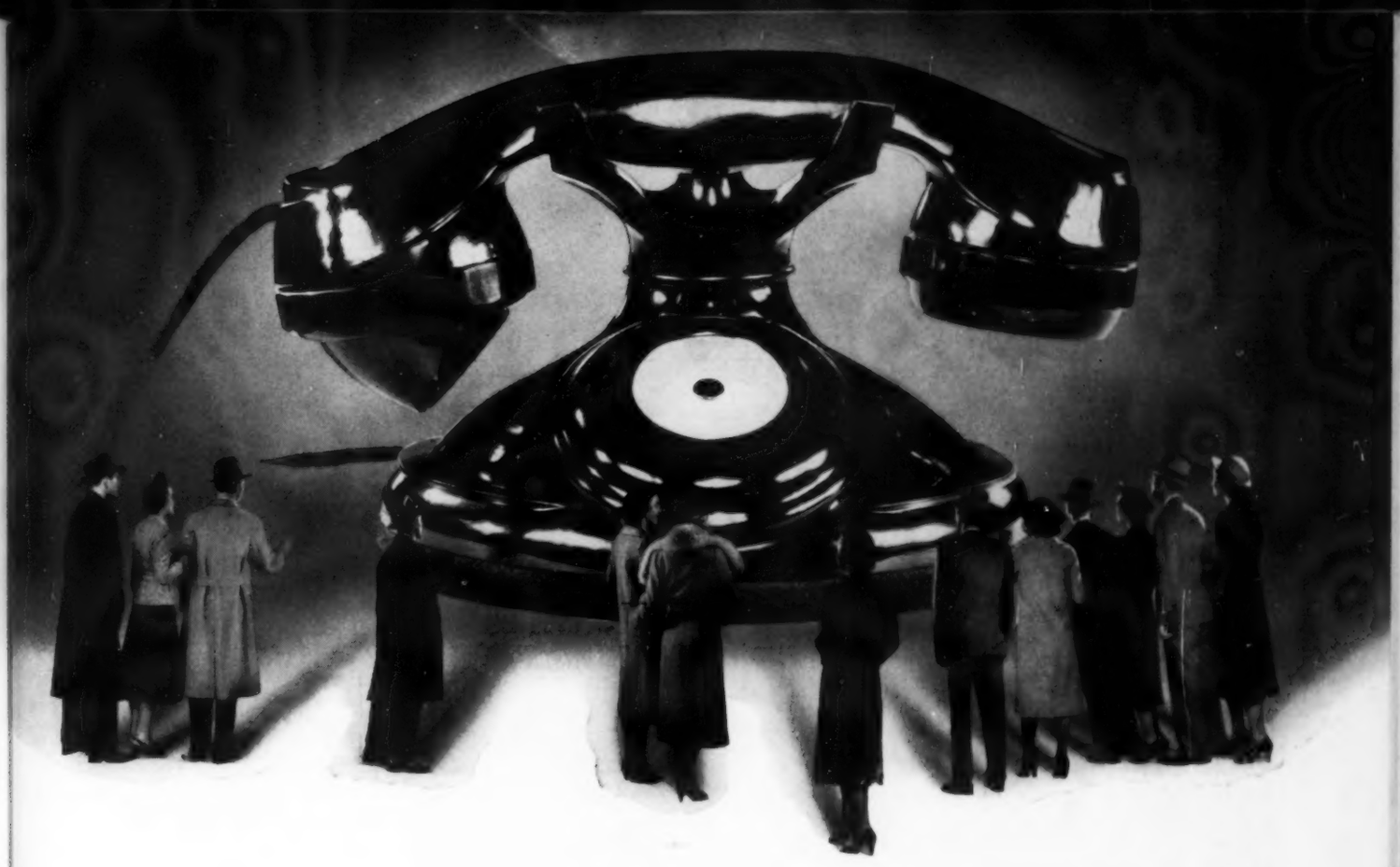
A typical parallel is shown between a three phase line and a telephone line in Figure 25 and the various lengths of each type of exposure which are designated as A, B, and C, are shown. If we substitute these values in the form shown in Figure 24, we can easily compute the total unbalanced longitudinal and transverse exposure. Inasmuch as the example given is completely coordinated, it will be observed that we have perfect balance, both from the standpoint of transverse and longitudinal induction. The residual components in the power and will of course be effective in inducing a longitudinal voltage in the telephone line.

The table (Figure 22) showing the relationship between the type of induction, type of power circuit and phase change due to a telephone or power transposition and for both residual and balanced power components will be found useful in computing equivalent lengths of untransposed exposure. For example, the table shows that longitudinal induction due to residual power

(Please turn to page 36)

Type of Power Circuit	Power Component	Type of Induction	Phase shift due to Tel. Trans.	Phase shift due to Pow. Tran.
Single Phase	Balanced	Longitudinal	0°	180°
Single Phase	Balanced	Transverse	180°	180°
Single Phase	Residual	Longitudinal	0°	0°
Single Phase	Residual	Transverse	180°	0°
Three Phase	Balanced	Longitudinal	0°	120°
Three Phase	Balanced	Transverse	180°	120°
Three Phase	Residual	Longitudinal	0°	0°
Three Phase	Residual	Transverse	180°	0°

Fig. 22 — Table Showing Phase Shift for Two Types of Induction for Various Transposition Arrangements.



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From those communities where operating companies are using the Stromberg-Carlson No. 1191 Handsets come words of heartiest praise for these instruments.

These enthusiastic praises are well deserved, for the Stromberg-Carlson No. 1191 Handset establishes new standards in the field of telephony.

It is economical for operating companies and pleasing to subscribers because it eliminates the old bell box—the instrument being completely self-contained with ringer, induction coil and condenser mounted in the base of the instrument.

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The special Stromberg-Carlson transmitter and receiver with which it is equipped permit a clarity of articulation previously undreamed of.

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BRANCH OFFICES: CHICAGO, KANSAS CITY, SAN FRANCISCO, TORONTO

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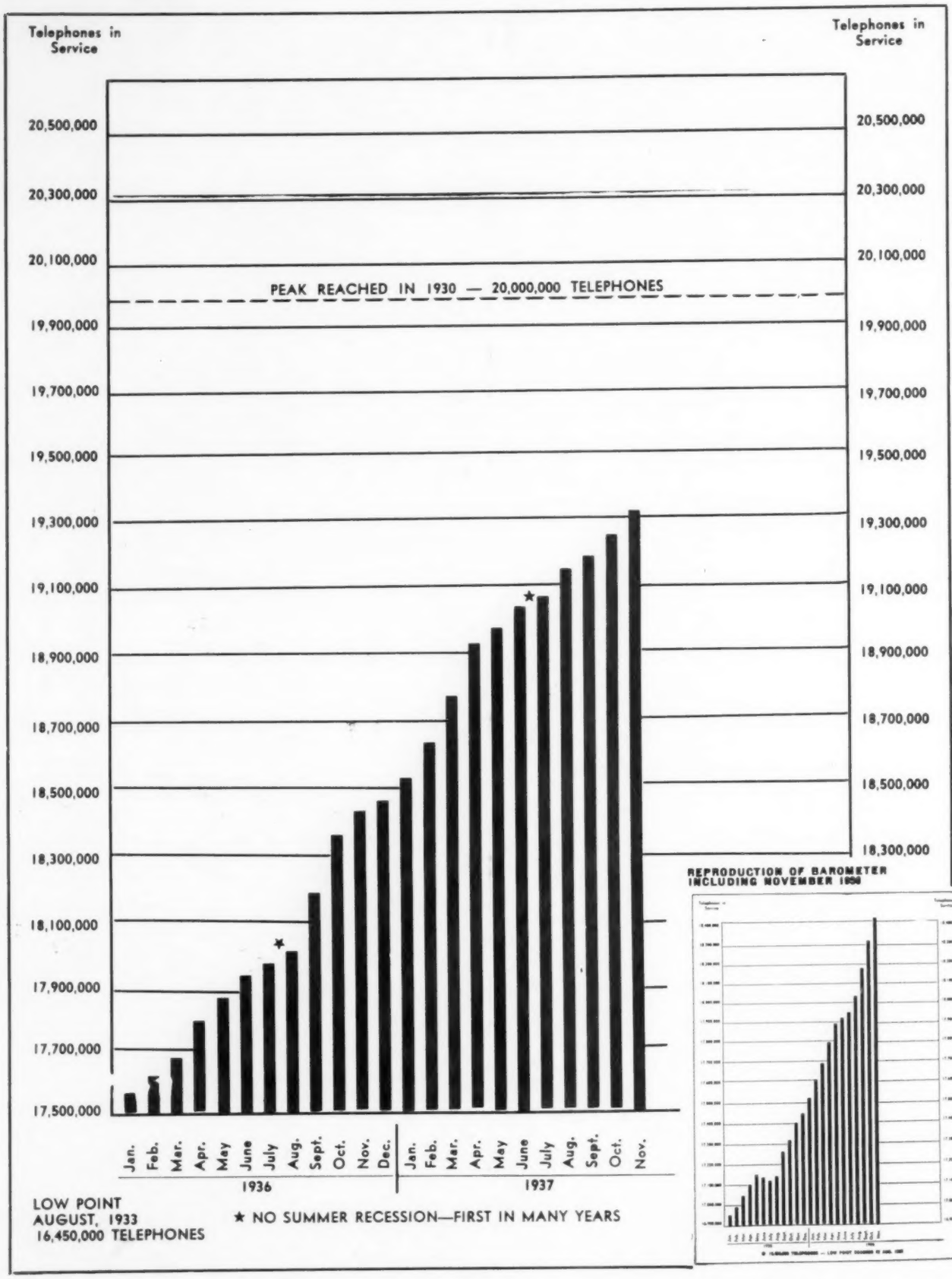

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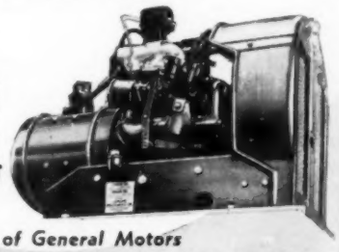

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MILLIONS OF MILES

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THOUGH it's only about 3000 miles from the Atlantic to the Pacific, the entire nation is knitted together by millions of miles of Perfected Telephone and Telegraph Wires. These wires are playing a prominent part in making modern communication systems dependable.

For over 100 years, the American Steel & Wire Company has been manufacturing wire of the highest quality. As a result, Perfected Telephone, Telegraph Wires and Strand are recognized from coast to coast as the best in quality, material and workmanship. They are being used by the leading communication and transportation companies.

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UNITED STATES STEEL

Minimizing Inductive Interference

(Continued from page 32)

components is equal to the total length of the power line. In other words, power transpositions are not effective in reducing this type of induction from residual components.

● After computing the total untransposed exposure involved in any parallel the engineer is then in a better position to recognize the need for modification or changes in existing transposition arrangement to improve the balances between telephone and power systems.

Effect of Crossovers on Phase of Induction

In a parallel at a point where telephone and power wires jump to opposite roadsides a change in the inductive relationship between the power and the telephone line takes place. Both longitudinal and transverse induction is changed by reason of the crossovers. It is possible to rearrange the power wires (by crossing transpositions) in the case of three phase circuits so as to obtain what is referred to as a **zero degree**, **120 degree** or **240 degree** phase shift in longitudinal induction before and after the crossover. Figure 26 shows the several types of crossing transpositions. On complicated parallels, these crossing transpositions are sometimes useful in obtaining longitudinal balance. The transverse induction in a telephone line before and after a crossover is 180 degrees plus the change in longitudinal induction. Crossover transpositions are used to obtain longitudinal balance and telephone circuits should be independently balanced against transverse induction to the point of crossover. Figure 27 shows how typical crossing transpositions might be used in specific parallels to improve the longitudinal balance to the telephone line.

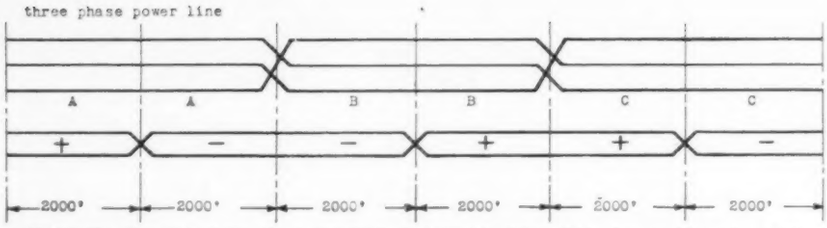


Fig. 25—Typical Three Phase Parallel Illustrating the Use of form shown in figure 24-A.

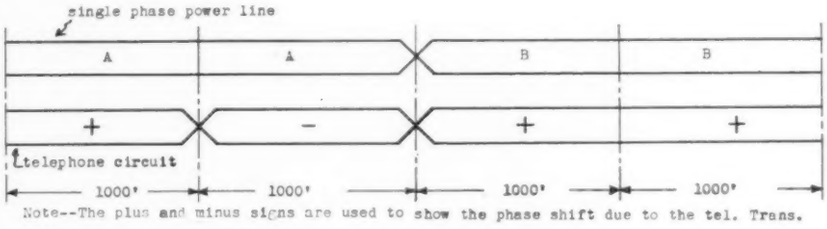


Fig. 23—Typical Parallel to Illustrate the Computation of the Equivalent Unbalanced Exposure. (Note—see data shown in form 24-B below.)

FORM FOR COMPUTING the EQUIVALENT UNBALANCED EXPOSURE for THREE PHASE POWER PARALLELS

Location of Parallel *one mile west of Hastings.*
Telephone Circuit No. *4*

+A	−A	+B	−B	+C	−C
2000'	*2000'*	*2000'*	*2000'*	*2000'*	*2000'*
Tot. *2000*	*2000*	*2000*	*2000*	*2000*	*2000*
Long. Ex.	*4000*		*4000*		*4000*
Trans. Un.	*0*		*0*		*0*

Transverse unbalance from residuals		Unbalanced exposure due to balanced currents and voltages		
		Transverse	EQ	Longitudinal
+	−	*0*	B	*4000*
2000	*2000*	*2000*	C	*4000*
2000	*2000*	*0*	B+C	*8000'*
2000	*2000*	*0*	A	*4000*
		0	−½(B+C)	*−4000*
6000'	*6000'*	*0*	X=A−½ (B+C)	*4000-4000=0*
		0	B−C	*4000-4000*
		0	Y=0.866 (B−C)	*0*
		0	U=(X+Y)	*0*

Fig. 24-A—Form for Use in Computing The Equivalent Untransposed Exposure for Three Phase Lines.

FORM FOR COMPUTING the EQUIVALENT UNBALANCED EXPOSURE for SINGLE PHASE POWER PARALLELS

Location of Parallel *South of Lincoln*
Telephone Circuit No. *6*

+A	−A	+B	−B
1000'	*1000'*	*1000'*	——
		1000'	——
Totals *1000*	*1000*	*2000*	*0*
Longitudinal Ex. *2000*			*2000*
Transverse Unbalance *0*			*+2000*

Transverse unbalance from residuals		Unbalanced exposure due to balanced currents and voltages		
		Transverse	EQ.	Longitudinal
+	−	*0*	A	*2000*
2000		*+2000*	B	*2000*
		+2000	A+B	*0*

Fig. 24-B—Form for Use in Computing the Equivalent Untransposed Exposure for Single Phase Lines.

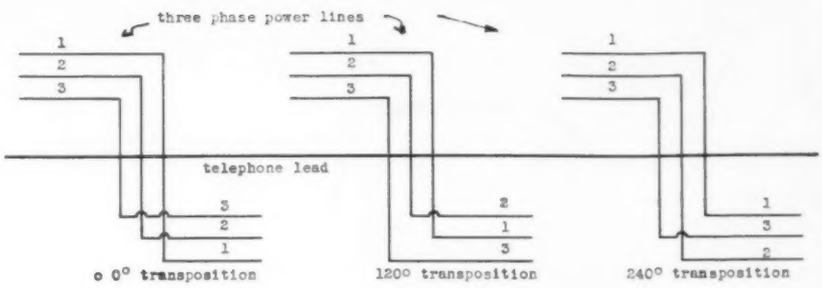


Fig. 26—The Three types of Crossover Transpositions.

Types of Power Lines

● Practically all of the major transmission lines are of the three phase type. Minor transmission lines between towns and rural lines for distribution to farms are generally of the single phase type. Three phase lines are more efficient than single phase lines from the standpoint of transmitting a given amount of power with the minimum conductor sizes. In addition, three phase power permits the use of large and relatively simple induction motors. Single phase motors require special starting windings.

A three phase system is one in which there are three single phase alternating current components with a phase difference of 120 degrees between them. There are two principal types of three phase systems in common use today, these are:

1. The **delta** connected three wire three phase system.
2. The **Y** (or Star) connected four wire three phase system. The three **wire Y** connected sytem has also been used although not as extensively as the four wire type of system.

● There are three kinds of four wire, three phase systems commonly used; one known as the **uni-grounded Y system** has a single ground at the power source, that is, the neutral wire is grounded at that point only, the other the **multi-grounded Y system** has grounds at various points along the neutral wires; namely, at all guying points, at all transformer locations, and at fixed distances along the line. The several types are shown in Figure 28.

Faults of Different Systems

The multi-grounded type system is becoming increasingly popular with power companies because of a number

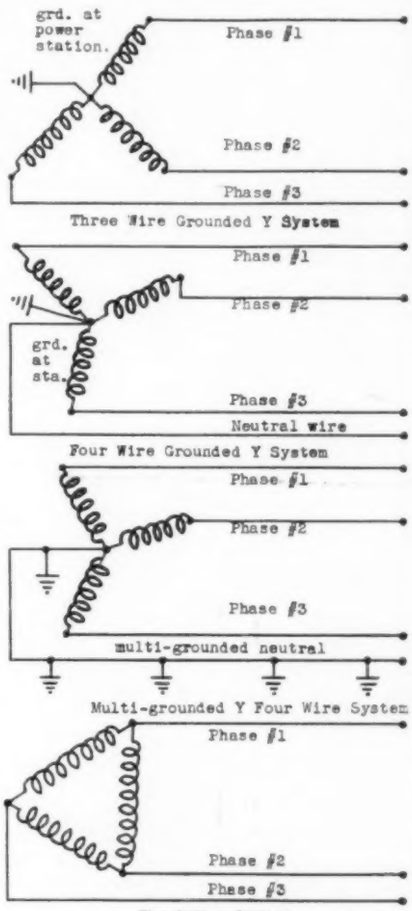


Fig. 28—Schematic Connections of the Principal Types of Power Lines.

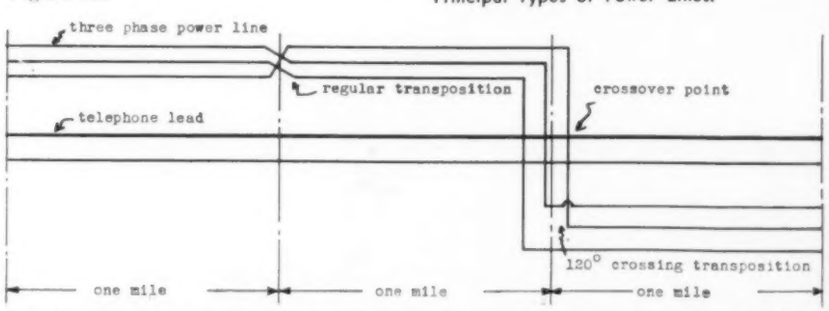
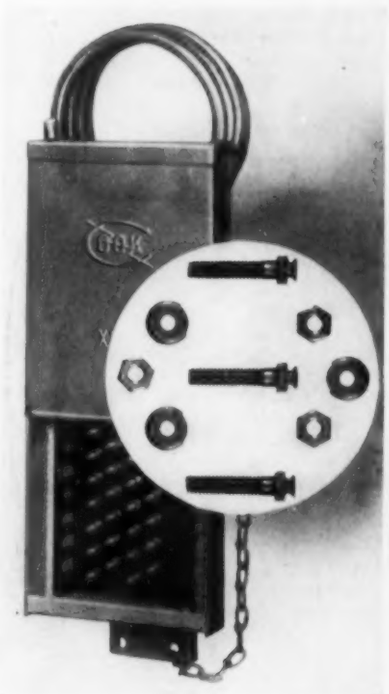


Fig. 27—Illustration of the use of a Crossover Transposition to give Longitudinal Balance on a three mile parallel.

COOK



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In the day by day performance of the Cook XB Unprotected Terminal, *Everdur* takes the spot-light as one important reason for its dependability.

Everdur is a non-corrosive metal of great strength, highly resistant to all atmospheric conditions—salt water fog, sulphur, smoke, etc. It is 96% copper, 3% silicon, 1% manganese.

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PROTECTION

BULLETIN No. 7

Non-Metallic Underground Telephone Cable

The development by the Simplex Wire & Cable Co. of rubber compounds having extremely low specific inductive capacity together with the discovery that by using deproteinized rubber (patented) an insulating compound can be made which will retain its electrical characteristics over an indefinite length of time when submerged in water or earth, has made possible a non-metallic underground telephone cable which does not require a protective sheath. Such a cable will have long life and maintain its telephone transmission efficiency over a period of more than forty years.

A rubber insulated cable when properly loaded will have a transmission equivalent not exceeding 0.2 db per mile at 1,000 cycles. This will permit installation of sections up to 50 or 60 miles without telephone repeaters. By the use of telephone repeaters such a circuit may be extended upwards to 400 or 500 miles.

The success of a non-metallic cable depends primarily on the low water absorption properties of the rubber. Insulating compounds made with deproteinized rubber have an accelerated water absorption of less than 0.010 grams per sq. in. of surface exposed to water at 70 deg. C. Other rubber compounds of inferior grades show water absorption from 0.040 upward on the same accelerated test. As a result of the low water absorption there is no appreciable increase of capacity or leakage with time. Once installed the electrical properties will remain practically constant insuring no increase in transmission loss.

The use of non-metallic underground cable is being rapidly accepted by telephone companies throughout the United States and many miles are being installed for rural communication and short toll circuits. This Company will be very glad to offer recommendations and suggestions as to the use of this new product. The reliability is obviously much greater than open wire construction and the over-all cost on an annual basis somewhat less in many cases.

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of advantages, chief of which is lower first cost. It is this type of system that is being widely used in connection with R.E.A. power projects. It has definitely been established that the grounded Y type of transmission network will create far more noise in paralleling telephone circuits than will **a well balanced** delta connected system. However, many delta connected power networks are so badly unbalanced due to metallic single phase taps on the three phase feeder lines that they are as bad from an inductive standpoint as is the grounded Y system.

● The single phase spurs of the four wire grounded Y system represent essentially grounded power lines (at least from an electro-static standpoint) and have particularly bad influence on paralleling telephone circuits. Delta connected systems, as previously stated, will have relatively high inductive influence on telephone circuits if they have single phase taps metallically connected to them. These metallic taps, however, can be effectively isolated so as to not unbalance the delta system by placing a transformer at the junction of the single and three phase lines. Power companies, however, usually object to this procedure due to the fact that the transformer serves no useful power purpose and does consume considerable power as well as representing a relatively high initial investment.

(To be continued)

NOTE—The writer wishes to give credit to Technical r port No. 66 of the Joint Committee on Inductive Interference for much of the information contained in this article. This report was originally published by th> Railroad Commission of the State of California.

COLORIZE In Showmanship

(Continued from page 20)

ing and in window displays. Use it on your trucks. An investigation of motor truck advertising shows orange to be the best attention attracting color.

Colored telephones are here to stay, just as sure as night follows the day. That thought may sound a little too progressive, but we can all remember the times when most automobiles were black. Now we have color in bathtubs, Kitchen-ware and women's overshoes. It is not hard to remember when people would have said you were crazy if you predicted such things. To sell colored 'phones, use a realistic window display. Borrow some furniture from a local company and give them a credit line in your window. Lay down some colored rugs and put the 'phone right out in front on a little table.

● Out in Oakland, Calif., The John Breuner Furniture Company ran a "Color Fair" with riotous combinations of color for home decorations,—an ideal spot for a colored 'phone to be displayed. As I read through trade papers in the furniture field I find more and more emphasis every year on color in the home.

Big strides are going to be made in color in the next couple of years. "Colorcable" is a machine which will transmit color by wire. Macy's flashed color from Paris in twenty seconds. The Colorcable message for a certain shade of blue might read as follows: "4 stop 62 per cent 67 stop 24 per cent 68 stop 14 per cent." Three colored paper discs start whirling on a phonograph turntable and at the point where the three discs overlap, the color combination is registered.

●With the successful use of color in "A STAR IS BORN," Technicolor becomes a reality and will have a big effect on merchandising. Adolph Ochs said that he hoped he would be dead before his conservative NEW YORK TIMES appeared in color. Unfortunately, his wish came true, but if you will peek at next Sunday's TIMES, you will find that color is doing a grand merchandising job for advertising. They are finding new uses for color all the time. Claret colored billiard tables are replacing the conventional green because claret gives less after-image. Owners of large sailing yachts are using colored sails so that boats can be identified more quickly.

Color—like the automobile—is here to stay. **COLORIZE!**

Government Census Of Telephones In 1938

The schedules to be used in the census of telephones and telegraphs, taken as part of the quinquennial census of electrical industries, will be sent out early in 1938, according to Director William L. Austin of the Bureau of the Census, Department of Commerce. The census will be taken almost entirely by mail and will cover operations during the calendar year of 1937.

The census will request important data on operations, employment, equipment and financial structure.

Employment information will include the number of employees as of June 30, 1937, and of December 21, 1937. Total salaries and wages paid for the year are also requested.

Leaders in the telephone and telegraph field are consulted by Census officials in formulating the schedules to be used in this canvass. Every ef-

fort was made to make the schedules as simple as possible in order to gather the necessary information with the least burden upon the respondents. It is extremely important that all items on the questionnaires be answered fully in order to facilitate the speedy completion of the project. If respondents will return the schedules promptly, it will enable the Bureau to publish the results quickly and thus enhance the value of the statistics.

Reports submitted to the Bureau are not available to any other government agency and cannot be used for purposes of investigation, regulation or taxation.

Postal and Western Union Face Monopoly Charge

Attorney General Cummings invoked the anti-trust laws Dec. 1, against the Western Union and Postal Telegraph systems, accusing them on conspiring to monopolize the telegraph business.

He asked the federal district court for southern New York to enjoin the two companies and their affiliates from enforcing contracts with railroads, hotels, and the like which give them exclusive privileges.

Specifically Cummings charged that the defendants had conspired to prevent other telegraph companies from erecting poles along railroad rights of way, from using railroad stations, and from establishing telegraph offices in certain hotels, clubs, and public and private buildings.

Commenting on the suit, R. C. Kramer, one of the trustees for Postal said:

"It has come to the attention of the trustees of the Postal Telegraph & Cable Corp. that proceedings against the telegraph companies have been commenced by the Attorney General of the United States, attacking the validity of exclusive contracts with the railroads and others.

"The question of the legality of such contracts has long been disputed between companies in the industry. We believe the question should be determined once and for all and a solution arrived at that is constructive for the entire telegraph industry."

Local Test Desk Operation

(Continued from page 22)

tant that the voltage of the test battery be the same as the value given in the chart. The test result is recorded on chart 2.

Although the insulation resistance of a telephone line is obtained from the test desk voltmeter or volt mil-ammeter as the case may be, frequently an additional test is necessary in order to verify the fact the line insulation does not break down under the influence of the comparatively high voltage of ringing and coin collector currents.

● In the Automatic Electric Companys test desk equipment refered to in pre-

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THE CREAM AT THE TOP

. . . Real quality identifies itself. Whether it be cream, or men, or hotels, outstanding performance is given top ranking. Few hotels in the world hold as prominent a place as the Stevens. To experienced world travelers, "The Stevens, Chicago," represents the cream of American hospitality, a tradition of excellence without extravagence.

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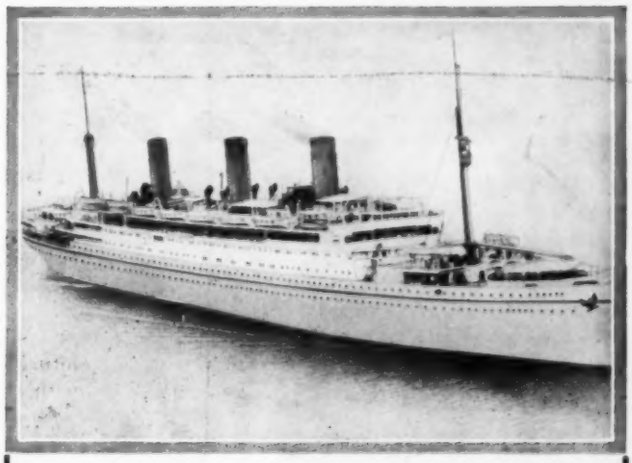

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- ☐ Lightweight Climbers.
- ☐ Specifications on Linemen's Belts and Safety Straps.
- ☐ Klein Kord Fabric Safety Straps.
- ☐ Pocket Tool Guide.

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vious articles, a breakdown test consists in connecting current from a 200 volt dry cell battery through two 110 volt 40 watt resistance lamps, then through the 0 to 600 milampere winding of the volt-milammeter to first one side of the line and then the other side and also across the line in such a manner that the station bells are not caused to ring.

To perform this breakdown test, the test man operates the "BRK. DOWN" test key and "REV" key as required which regulates the current flow and operates the breakdown test apparatus. While this equipment is in operation, the test man watches the volt-millammeter. If the meter needle deflects in excess of 0.020 amperes (20 milliamperes) it is an indication of a breakdown which may have occurred between the side of the line tested and the earth, such as a cable conductor and the lead sheath, a drop wire and the limb of a tree, protector carbon blocks, damp inside wire, poorly insulated cord connected to the station subset and etc. With the "REV" key in it's normal position, and only the "BRK DOWN" key operated the "L 2 or ti) side of the line is tested. To test the L or ring side of the line the "REV" and "BRK. DOWN" keys are operated. The test goes through each cycle of testing in approximately ten seconds.

● On new telephone installations and in cases of "Can't hear, or Can't be heard" speech transmission complaints, a transmission test is necessary. It is undoubtedly very well known that in a telephone system speech is transmitted by means of electric currents which are varied in value by a telephone transmitter and corresponding with the original speech sounds, and which cause the reproduction of these speech sounds at the receiving end of the line. Authorities state that the quality of speech transmission is in the majority of cases dependent upon the degree of loudness of the reproduced speech, upon the accuracy of it's reproduction, and upon the degree of uniformity with respect to both. Further, it is also said that the degree of loudness of speech telephonically transmitted is directly dependent upon the amplitudes of each of the separate components of the speech current in the telephone receiver and on the efficiency of the receiver and the sensitivity of the listeners ear throughout the whole range of speech frequency. The receiver current is in turn dependent on the efficiency of the transmitter and on the attenuation resulting from the line and equipment characteristics."

By attenuation is meant the decrease in intensity, value, or amplitude of an electrical current between the transmitting and receiving ends, that is, the value of a variable speech current may not be the same in all parts at any given instant, but may decrease gradually as the distance from the transmitting end of the line increases. This reduction is said to be due to the resistance of the line conductors, insulation resistance, and relative values of distributed capacitance and inductance of the circuit.

● The details of making a transmission test from an A. E. Co. local test desk embodies the following features; (1) Use is made of an adjustable rheostat connected in the line circuit for reducing the battery current through the transmitter at the subscriber's station being tested to a definite value which will be the same for tests on all lines, thus by equalizing the battery supply losses and minimizing differences in attenuation losses on the different lines tested, produce a fairly uniform test condition and one which will permit of a definite loop condition being used as a basis of comparison. (2) The employment of an artificial line to be connected in the transmission test circuit, between the line side of a repeating coil supplying battery to the subscriber's loop and the test desk telephone set. The purpose of this artificial line is to increase the total transmission equivalent of the testing circuit to approximately thirty miles of standard cable. (3) Operating the "T M T" (transmission test) and the "T. B A T T." keys, the testman conducts a talking test between himself and an installer or a repairman located at the subscriber's station. It is very essential that each is careful to talk in the same manner and in the same relative position with respect to their transmitter. The test should render it possible to discover equipment faults which would cause serious transmission losses.

(TO BE CONTINUED)

Florida Mayor Puzzled By Telephone Music

Jacksonville city fathers received a shock recently when Mayor Blume insisted on calling in the telephone company when his deskset started carrying opera, hill billy music, and continued to do so.

To make it more puzzling it abruptly stops when the operator cuts in for her familiar "Number Please." J. C. Buchanan, manager of the telephone local office, stated specifically it was not a new service installed to put subscribers in good humor when bills were out.

Jacksonville is a key station for chain broadcasts, so you engineers can write your own answer.

New Kellogg Masterbuilt Junior Appears

Any telephone man operating an exchange with 50 to 250 subscribers, will find the new Masterbuilt Junior switchboard well worth investigating. This new common battery equipment was recently announced by the Kellogg Switchboard and Supply Company of Chicago. It was especially designed to meet the requirements of companies operating magneto exchanges in towns where excessive future growth is not anticipated.

In the past, telephone subscribers in such towns have been penalized simply because an economical method of giving reliable battery service was not available. Yet, these same subscribers have come to expect modern telephone service along with automobiles, radios, electricity and the other up-to-date things they are now enjoying.

The introduction of Masterbuilt Junior brings common battery service within reach of these smaller exchanges. This is not only feasible, but highly desirable because revenues can be increased at the same time that service is improved and operating costs reduced.

Each unit of the Masterbuilt Junior has an ultimate capacity of 200 town lines, either universal or common battery, and 40 farm or toll lines. It comes with just enough equipment to handle present traffic requirements, and when the switchboard becomes filled to its capacity another unit may be placed alongside without multipling the two together.

This equipment can be arranged so that only one line at a time may be converted to common battery if desired. Such an arrangement often makes the program easier to handle, and this method is used by the majority because it is more economical. Wired for 15 universal cord circuits, either manual or automatic ringing and any type of party-line service may be obtained.

The foundation of this switchboard is a rigid steel framework. Like other boards of the Masterbuilt line, the swinging gate carries the line, cord and miscellaneous relays, and permits easy access to all parts. The beautiful, smooth panels and top with rounded egdes make a rich contrast with the black Bakelite face and keyshelf.

Among the qualifications of this new switchboard are economy in first cost, simplicity of operation and ease of maintenance. In addition it enables a telephone company to collect revenues commensurate with a high grade, dependable and speedy telephone service. Each Masterbuilt Junior is shipped completely set up and ready for a quick, easy installation. Even the line cables are attached and ready for connecting to the main distributing frame

With this new equipment now available, present magneto exchange owners need no longer wait for a large subscriber increase to warrant giving common battery service. The low cost ease of installation and all around simplicity of the Masterbuilt Junior, make it a simple matter to give subscribers the speedy up-to-date service which they want. Operating costs, too, are lower, and offers a still further incentive to convert to this modern equipment at once.

Propose Government Service In Montana

Proposal of a telephone line serving 600 subscribers and estimated to cost $140,000 to be erected by the federal government was carried in news dispatches during November.

From Polson, Mont., comes the news county officials had been notified by Washington that the telephone system for the Flathead project had been referred to the project manager, Henry Gerharz of St. Ignatius.

More Hours of Service

. . . that's what every telephone engineer seeks . . . *more hours of service* . . . which means fewer replacements, lower service costs! And that's exactly what Ray-O-Vac telephone batteries offer!

For 3 decades Ray-O-Vac batteries have met and exceeded specifications and requirements on every recognized telephone and light intermittent test, and surpass all government standards. For lower service costs, specify Ray-O-Vac!

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Formerly FRENCH BATTERY COMPANY
MAIN OFFICES AND PLANT
MADISON, WISCONSIN
Additional Factories at
Clinton, Massachusetts and Lancaster, Ohio

New nut housing. Locks Anchor firmly on rod. Rod cannot slip thru Anchor when being installed.

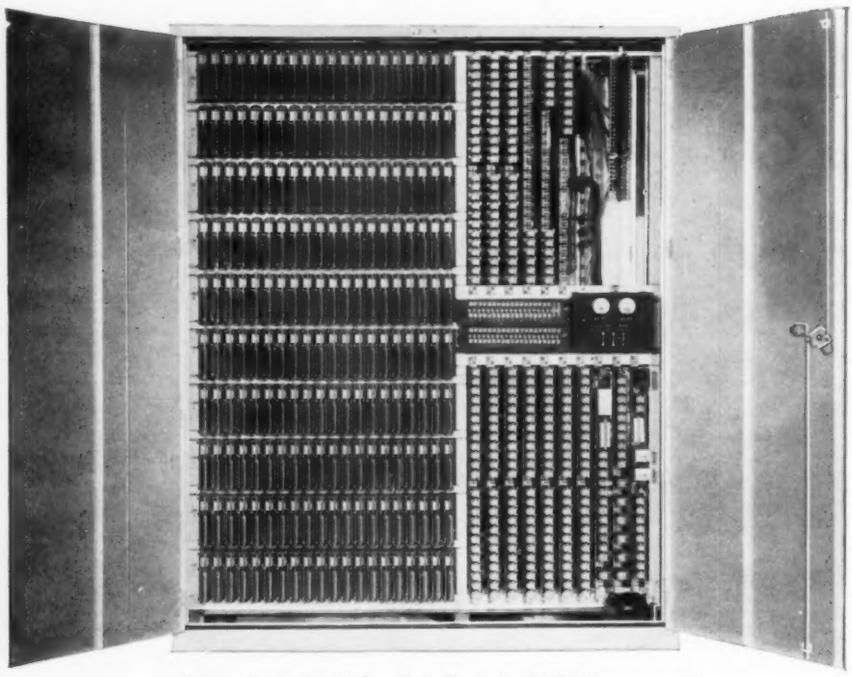
EVERSTICK ANCHORS...

Engineers appreciate Everstick features which assure safety, long life and ease of installation in any soil condition.

A complete line with 3 types of expanding Anchors and rigid types of Cone Anchors. All sizes and holding capacities. Write for Everstick literature including new folder on Rural Electrification Lines.

THE EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

Automatic Introduces Improved Relay-Type Board



Automatic Rotor Relay Switchboard of 100 line capacity

Automatic Electric Company has announced important new additions in its line of relay-type switchboards for unattended automatic exchanges. These improved boards, known as "Automatic Rotor-Relay Switchboards," make use of a newly developed multi-contact rotor relay, which is characterized by unusual simplicity in its mechanical design.

Automatic Rotor-Relay Switchboards are designed for service with magneto and common-battery telephones on grounded or metallic lines. The boards can therefore be used in practically all cases with existing plant, and require only the addition of dials on the telephone instruments. They provide for individual line, 2-party full-selective, 4-party and 10-party divided, and 20-party bridged code-ringing service. They also permit post-payment coin box service on metallic common-battery lines. Ringling is automatic and intermittent.

The boards may be trunk-connected to one or two neighboring exchanges, either automatic or manual, and the operation of the equipment checked from one of these exchanges, whenever desired, by dialing a supervisory number.

The equipment of the switchboards, comprising line equipments, connecting "links," and trunk equipments, consists

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Come and Play ~ Regain Health

Stop at **MAJESTIC HOTEL**
BATH HOUSE AND APARTMENTS

The Majestic offers a wide choice of accommodations from single rooms, with or without bath, to beautifully furnished 2, 3, and 4 room apartments, assuring maximum comfort amid attractive surroundings. Rates are surprisingly moderate from $1.50. Two restaurants serve excellent food.

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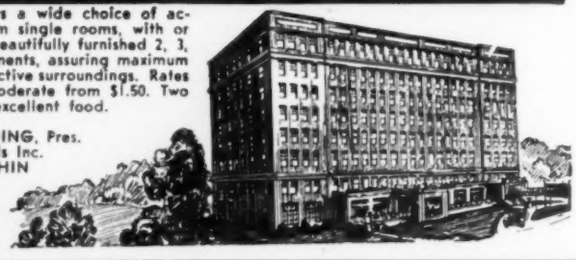
R. E. McEACHIN
Manager



of Automatic Rotor Relays, and Automatic Electric's "horizontal" relays. Each link consists of a relay group, and a finder Rotor Relay and a connector Rotor Relay for each group of lines. The finder connects to a calling line, and the connector completes the desired connection in accordance with the digits dialed by the calling party.

For simplicity, the trunks are terminated on subscriber-line equipments, the subscriber-line capacity of a board is therefore reduced by one for each trunk equipped.

Automatic trunk selection is provided in each exchange group, requiring only one digit to be dialed for outgoing calls.

Automatic Rotor-Relay Switchboards are offered in a wide range of sizes—the smaller sizes including a 30-line board having a maximum capacity of four links and five trunks; a 60-line board with a maximum capacity of seven links and ten trunks; and a 100-line board, with a maximum capacity of ten links and ten trunks. Switchboards are supplied equipped as specified to meet initial requirements, and lines, links and trunks may be added in the field as required.

The boards are assembled on double-sided frameworks of steel, with gasketed sheet-metal covers for protection against dust. Cabinets are 2'-5", 4'-0" and 5'-7" wide (for the 30-, 60, and 100-line switchboards, respectively), and 2' 0" deep, and are only 6'-9" high, so these C-A-X's can be housed in rooms of ordinary ceiling heights.

Switchboards are of the unit type, with power equipment mounted separately. Installation consists of only the connecting of the line cables, trunk cables and power wiring.

"Tapping In" On Washington

(Continued from page 16)

set for hearing the acquisition of a $3,000 mutual telephone company by the Indiana Bell Telephone Co. is believed to mean that the Federal body is going to adhere to a rigid policy of holding hearings on every acquisition case, no matter how small. Another possible policy is that every new foreign overseas radiotelephone circuit also will be subjected to an inquiry as was evidenced by the FCC's decision for a hearing upon the application of the Radio Corporation of Porto Rico (I.T. & T. subsidiary) for a radio telephone circuit between Porto Rico and Haiti. It had followed this policy previously in staging a hearing on the RCA Communications application for a radiotelephone circuit to link up the Mutual Telephone Co. of Hawaii with Tokyo, Japan, although there had been no controversial aspect to the plan.

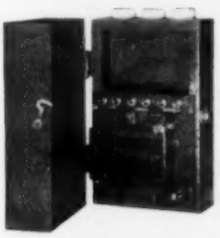
● The reorganization of the FCC has brought about the assignment of routine applications and matters coming to the Commission to be handled by the individual Commissioners so as to leave the time of full Commission meetings open for discussion of major policies and problems. Each Commissioner will serve for a month in charge of a different batch of routine assignments and then will rotate to another assigment. One group of assignments would entail the supervision by a Commissioner over routine wire certificates and extensions of facilities and another assignment entails the handling of all tariff matters. Three other assignments for as many Commissioners are on routine matters connected with the radio phases of the FCC's work. The Commission will meet every Tuesday on telephone and telegraph matters, according to the schedule recently announced by Chairman McNinch.

Bell Accepts Illinois Rate Reduction

The Illinois Bell Telephone Company will obey the orders of the Illinois Commerce Commission and put in effect new rates January 1, which will result in savings of approximately $5,715,000 annually for Illinois 'phone users.

On the heels of the I. C. C. ruling, Vice President A. H. Melinger of the company, said the rates would be put into effect and no effort made to appeal to the courts for relief from the order, He said:

"In the hope business will continue to improve, and to avoid the cost of contesting the order, the Illinois Bell



The New A-C SUPER-SENSITIVE J-C

RECTIFIER TYPE SIGNAL RELAY

● Operating current 200 micro-amp (.0002 amp) at any frequency up to 15,000 cycles — RUGGEDLY BUILT—EASILY ADJUSTED. It solves the telephone signaling problem. Write for descriptive bulletin.

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In the manufacture of its insulation Whitney Blake incorporates anti-oxidents in combination with other ingredients which result in an age resisting, tougher compound, more highly resistant to any compression or strain encountered in service. "LONG LIFE" "WB" wire is the most economical that you can buy.

Illustrated is No. 17—Drop Wire Parallel. Spec. 5791.

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Should be one who has had the practical experience of Operating, Owning and Managing Telephone Plants. He should be a specialist in Telephone Accounting. He should be able to make up the books in his office from data supplied by you, and at a nominal cost. He should supply the necessary reporting Forms without charge, and be ready to assist you with your various annual Government or State reports.

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12 years experience as lineman and trouble shooter and construction. Will go anywhere that I can make living wage. 30 years old. Herman Callaham, Broken Bow, Okla.

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Self-adjusting to changing impedance. No balancing nets. Adapted to Line, Terminal and Cord-circuit uses. Accurate balance; high gain.

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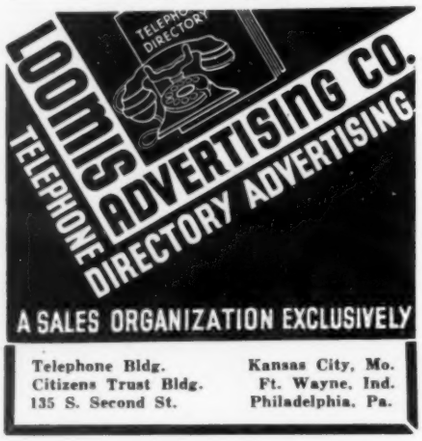

Telephone Bldg. Kansas City, Mo.
Citizens Trust Bldg. Ft. Wayne, Ind.
135 S. Second St. Philadelphia, Pa.

Telephone Company has decided to introduce the new rates for trial and to ask the commission for a revision later if the returns do not prove adequate.

"While the order will cause a greater loss of revenue than seems warranted by present conditions, it introduces some entirely new rate classifications which offer definite improvements as well as savings to customers."

The commission's order sliced rates an aggregate of $2,650,000. Further it forbade the company to pass on the state sales tax to customers and ordered discontinuance of the 15 cent monthly fee for cradle phones.

For toll charges briefly the new rates effective January 1 will be 4 cents for calls presently costing 5; 8 cents for 10 cent calls and 12 cents for calls now charged at the rate of 15 cents. Suburban areas touching city sections will be able to telephone for 5 cents instead of the present charge of 10.

Utilities Seek Reorganization

Petitions for corporate readjustment under section 77-B of the bankruptcy act were filed in federal court Nov. 29, by the Continental Public Service Company, an Arkansas holding company, and four subsidiaries. The petitions stated affairs of the companies were so closely interwoven that reorganization of all was desired.

The companies operate water, gas and telephone utilities in Texas, Wisconsin and Arkansas, the subsidiary companies being: Interstate Public Service Company, an Arkansas corporation; Central West Water and Power Company, a Delaware corporation; Interstate Telephone Company, a Texas corporation, subsidiary to Interstate Public Service Company, and the Eureka Utilities Company, Wisconsin corporation.

Assets and liabilities of the companies were listed at about $2,335,000. E. A. Henry and R. R. Suttle were appointed temporary trustees under bond of $25,000 and hearing was set for 10 a. m., December 27, before Judge Trimble, on appointment of permanent trustees.

Claims against the companies must be filed within 120 days.

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New Leich Hand Sets
Reconditioned Boxes
(Send for circulars)

Buckeye Telephone & Supply Company

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Genuine Western Elec. No. 20AL desk set with No. 315 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set @ 10.00

Western Elec. No. 20AL. desk set with Transmitter, Rec. & Cord less signal set @ 5.50

Kellog No. 118 desk set with Trans. & Rec. Complete with 3-bar 1000-1600 or 2500 ohm ringer external post connection set @ $8.50—5-bar @ 10.75

Kellogg No. 2808 Pony type 3-bar 1000-1600 or 2500 ohm ringer compacts with short arm @ $9.00—4-bar @ 10.50

Kellogg No. 2696 type 4-bar 1000-1600 or 2500 ohm ringer compacts with short arm @ 8.00

Kellogg No. 84 unbreakable desk set with No. 2328 3-bar 1000-1600 or 2500 ohm ringer insise connection signal set @ 10.00

Stromberg Carlson No. 896 Pony type 3-bar 1000-1600 or 2500 ohm ringer compacts with short arm and slope shelf @ 8.75

Stromberg Carlson No. 988 desk set with 3-bar 1000-1600 or 2500 ohm ringer external post connection signal set $8.75—4-bar @ 9.50

Monarch No. 33 desk set with 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set @ 7.85

Dean Elec. Co. desk set with 3-bar 1000-1600 or 2500 ohm ringer inside connection signal set @ 8.25

Western Elec. No. 20 desk set with Dean or Monarch Trans. complete with external post 3-bar 1000-1600 or 2500 ohm ringer signal set @ $7.75—4-bar $8.50—5-bar @ 10.00

Western Elec. No. 122 Receivers with posts less cord @ ..... .65

Write for Bulletin

REBUILT ELECTRIC EQUIPMENT CO.
1934 West 21st St., Pilsen Sta.
Chicago, Ill.

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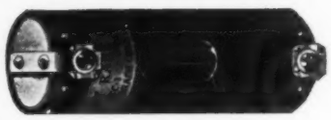
Entirely NEW in Telephony!



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Rare Gas Lightning Arresters
Test-O-Lite, Etc., for 30 Years

DRILLS HOLES IN CONCRETE
FOR EXPANSION BOLTS, CONDUITS, ETC.

WODACK "DO-ALL"
This is the electric hammer that can be changed to a drill for metal and wood. Two sizes. Ask for prices.
Wodack Elec. Tool Corp. 4637 W. Huron St. CHICAGO, ILL.

Crapo
GALVANIZED PRODUCTS

Where strains and stresses are heaviest, where corrosion takes its greatest toll, *Crapo* Galvanized Telephone Wire and Steel Strand long ago demonstrated their outstanding superiority. The heavy *pure* zinc galvanized coating, maximum tensile strength and proper ductility insure longer life and lower maintenance cost. Insist upon *Crapo* Galvanized Products for better performance under all conditions!

Indiana Steel & Wire Co.
Muncie, Indiana

Crapo Galvanized Products are available in all standard grades and sizes.

NOW - NICOPRESS

Above illustration shows completed splices on Parallel Pair Drop Wires.

Illustration shows No. 17 Nicopress Tool. Exact Size.

SLEEVES

Above illustration shows Nicopress Sleeves for No's. 17 & 18 Drop Wires.

In the Drop Wire Field

The Quickest – Easiest – Most Economical Way to Splice Parallel or Twisted Drop Wires

That there is no better way of making line joints, than the National Nicopress way. This has been proven by years of test by telephone companies, large and small, in all sections of the country.

Now — with the completion of the Number "17" Nicopress Tool this ideal method of making line joints has been made available for Drop wires (Parallel or Twisted Pair).
With the light, practical, convenient Number "17" Nicopress Tool and Nicopress Sleeves you can splice No. 17 and 18 B. & S. wire more quickly and easily than ever before. And once made the joints will be uniform, they will have maximum strength and tightness and will be proof against air and moisture.

The Number "17" Nicopress Tool illustrated on this page, actual size, is but 8" long and weighs but 8 ounces, — it requires no adjustment and is sturdily constructed to withstand hard continuous use.

This Number "17" tool is useable with bronze, copper or copperweld wire. The Nicopress Sleeves for Drop Wire Service have all the advantageous features found in Nicopress Sleeves for large size wire in tightness, strength, economy and convenience.

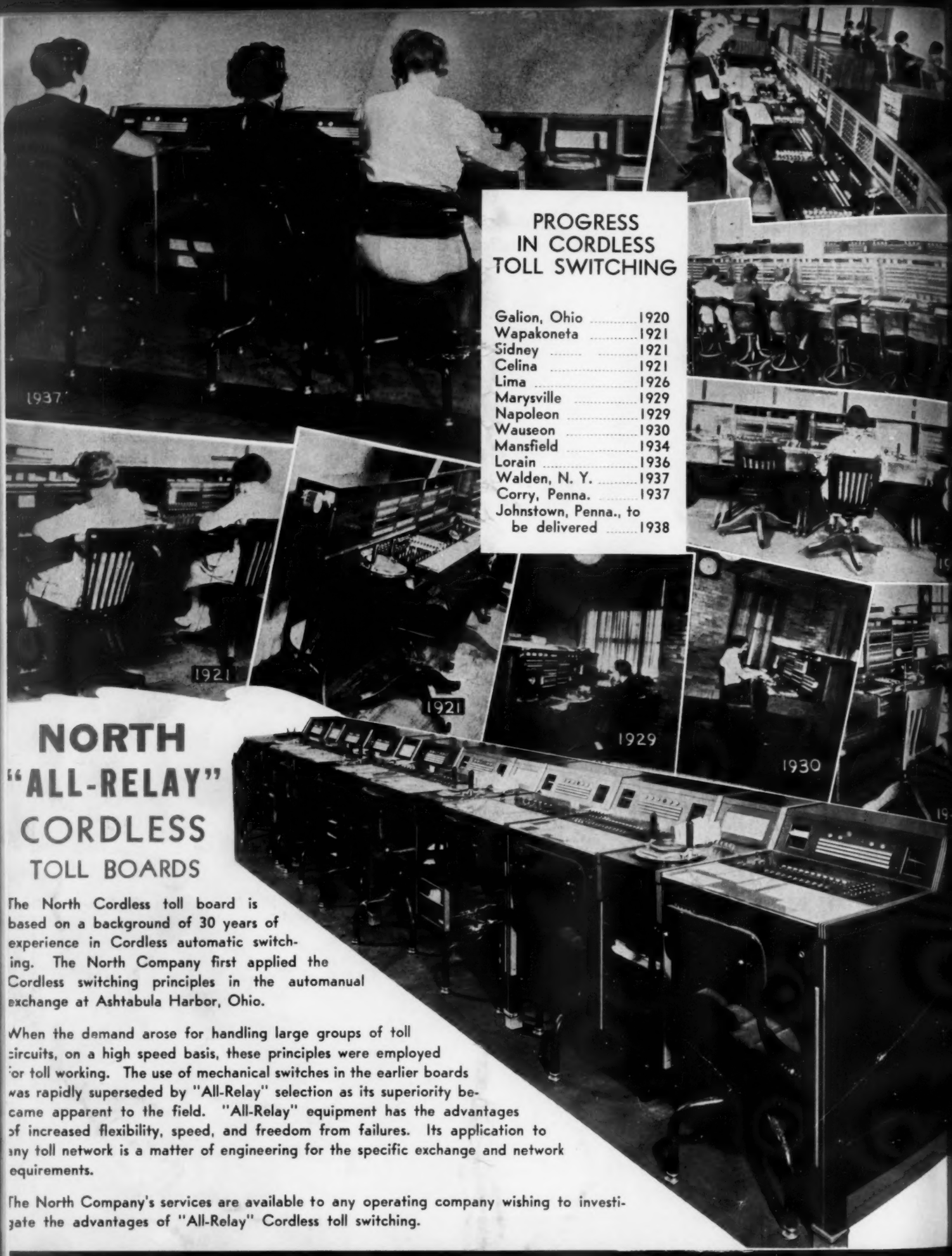
It will pay you to investigate the Nicopress method of splicing Drop Wire. Write today for details and prices.

NO. 17 NICOPRESS TOOL Only $2.00

THE NATIONAL TELEPHONE SUPPLY COMPANY

5100 Superior Avenue — Cleveland, Ohio

If it's a SPLICE make it a NATIONAL NICOPRESS



PROGRESS IN CORDLESS TOLL SWITCHING

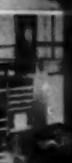
Galion, Ohio	1920
Wapakoneta	1921
Sidney	1921
Celina	1921
Lima	1926
Marysville	1929
Napoleon	1929
Wauseon	1930
Mansfield	1934
Lorain	1936
Walden, N. Y.	1937
Corry, Penna.	1937
Johnstown, Penna., to be delivered	1938

NORTH "ALL-RELAY" CORDLESS TOLL BOARDS

The North Cordless toll board is based on a background of 30 years of experience in Cordless automatic switching. The North Company first applied the Cordless switching principles in the automanual exchange at Ashtabula Harbor, Ohio.

When the demand arose for handling large groups of toll circuits, on a high speed basis, these principles were employed for toll working. The use of mechanical switches in the earlier boards was rapidly superseded by "All-Relay" selection as its superiority became apparent to the field. "All-Relay" equipment has the advantages of increased flexibility, speed, and freedom from failures. Its application to any toll network is a matter of engineering for the specific exchange and network requirements.

The North Company's services are available to any operating company wishing to investigate the advantages of "All-Relay" Cordless toll switching.

THE NORTH ELECTRIC MANUFACTURING Co

GALION, OHIO